APR 10 1912

LIBRARY OF CONGRESS
APR 10 1912
COPYRIGHT DIV.

JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

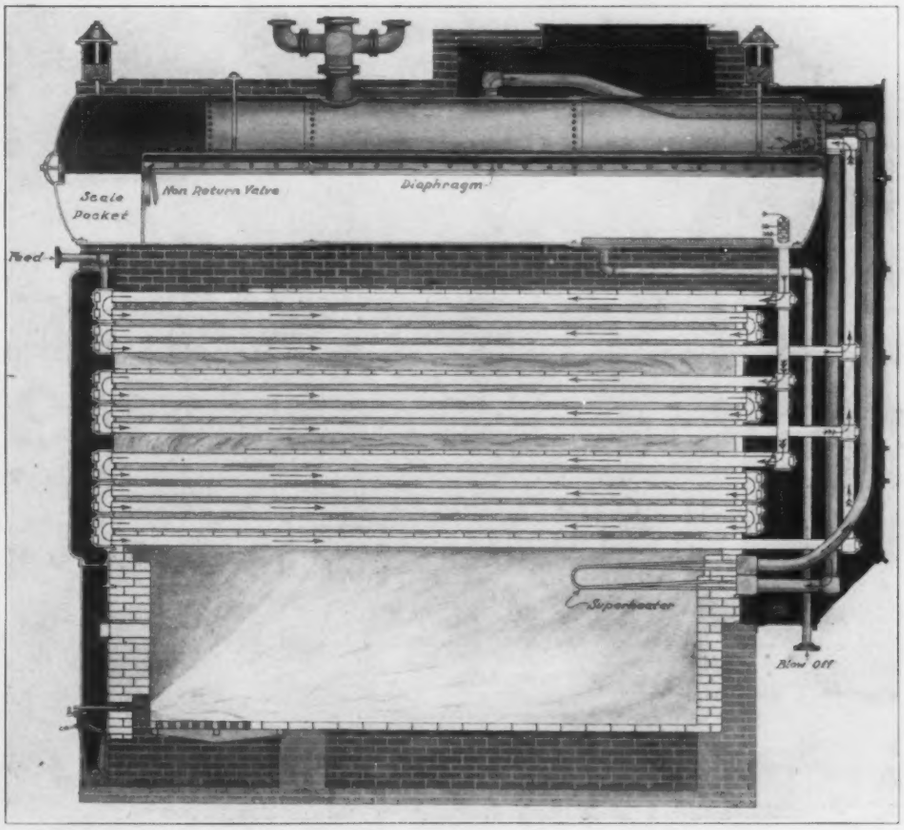
Entered as second-class matter May 7, 1906, at the Post Office at San Francisco Cal., under the act of Congress March 3, 1879

VOL. XXVIII NO. 14 — SAN FRANCISCO, APRIL 6, 1912 — PER COPY 25 CENTS

THE REASONS WHY

THE PARKER BOILER

IS SO EFFICIENT



1. The horizontal baffles give the gases a very long travel.

2. A large part of the scale cracks loose, and is carried out of the tubes and is deposited in the drum by the rapid circulation of the water and steam.

3. The coolest water passes through the upper or economizer elements, where it comes in contact with the coolest gases. The difference in temperature between the two greatly increases the transfer of heat and thereby reduces the temperature of the escaping gases to a minimum.

4. Steam is delivered directly from the hottest part of the furnace to the drum without passing through the water, thus insuring dry steam.

KEYSTONE BOILER WORKS

PACIFIC COAST AGENTS

201 FOLSOM STREET, SAN FRANCISCO

Alphabetical Index to Advertisers, Page 8. Where to Buy It in the West, Pages 9, 10, 12.

Safety Paper-Insulated Cable

ANOTHER SAFETY STANDARD

For Central Station Power Distribution

Careful selection of the materials used in the manufacture of our paper and lead cables, coupled with experienced engineering skill and thorough workmanship, must produce the most efficient product.

We developed and patented an insulating oil, which thoroughly impregnates the manila rope paper without decay or oxidization, and is equally absorbed by every layer—insuring equal breakdown strength on the inner layers as well as the outer.

We carry large stocks of single and duplex paper and lead cable for secondary and primary voltages in San Francisco for immediate delivery and solicit your inquiries on any underground cable installations, large or small.

Cable Terminals and Potheads — Compound and Tape.

LET US ESTIMATE YOUR UNDERGROUND EXTENSIONS

The Safety Insulated Wire and Cable Co.

RALPH L. PHELPS, MGR.

Pacific Coast Dept., 589-591 Howard St.

SAN FRANCISCO

SEAMLESS RUBBER SAFETY INSULATIONS

THE LAMPS

THAT BURN LAST ARE BUILT ARE SOLD ARE SHIPPED RIGHT

ARE

ECONOMY LAMPS

DISTRIBUTORS FOR CALIFORNIA:

COLONIAL ELECTRICAL AGENCY CO.

444 MARKET STREET, SAN FRANCISCO (PHONE KEARNY 517)

THE ECONOMY ELECTRIC CO., MANUFACTURERS

WARREN, OHIO.

B273268

JOURNAL OF ELECTRICITY
POWER AND GAS
Devoted to the Conversion, Transmission and Distribution of Energy

VOLUME XXVIII SAN FRANCISCO, APRIL 6, 1912 NUMBER 14

[COPYRIGHT 1912 BY TECHNICAL PUBLISHING COMPANY]

TURBINE AND BOILER EFFICIENCY TESTS IN OAKLAND[1]

BY ROBERT SIBLEY AND R. F. CHEVALIER.

Some years ago the Pacific Gas & Electric Company installed at their Station "C" in Oakland, California, a 9000 kw. vertical Curtis turbine. During the past months the generating output of this station has been largely augmented by the installation of a 12,000 kw. similar unit. In order to house the new equipment, the building formerly occupied, has been extended considerably to the south and now has a substantial concrete front.

The steam consumption of this new turbine in lb. per kw. hour, with a steam pressure of 175 lb. (gauge) at the throttle, was guaranteed not to be more than 15.2 at 7500 kw. output, 14.5 at 10,000 and 14.6 at 12,000, with not more than 1½ lb. absolute back pressure in exhaust chamber of turbine, dry steam, 100 deg. F. superheat.

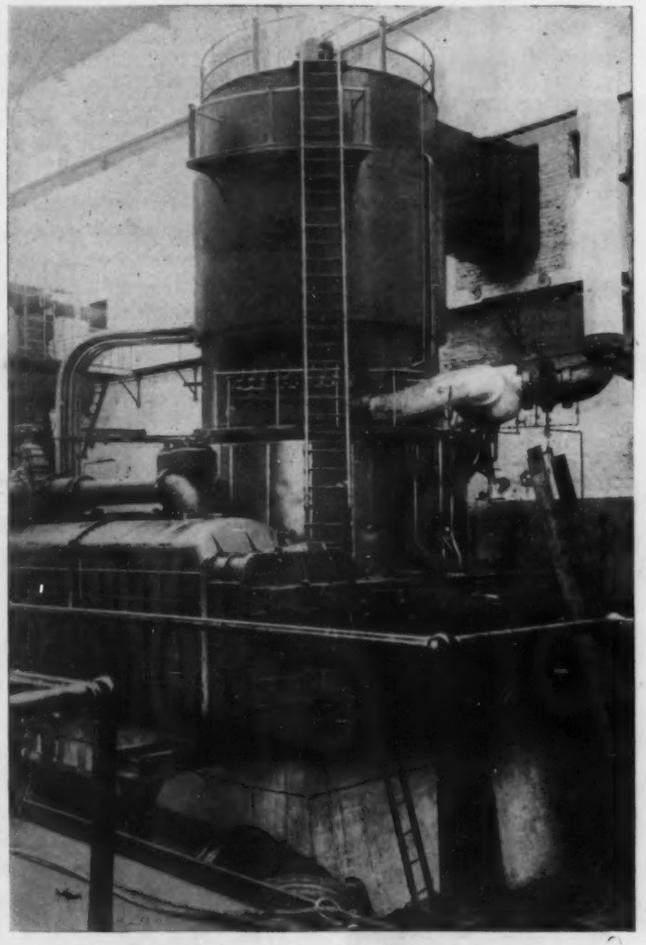
The following correction factors were agreed upon to apply if exact contract conditions could not be maintained while steam consumption tests were made.

1 in. absolute back pressure in condenser is equivalent to 1 lb. in water rate per kw. hour between 2 in. and 1 in. absolute back pressure at loads ranging from 10,000 to 12,000 kw. At loads less than 10,000 kw., 1 in absolute back pressure is equivalent to 1.2 lb. in water rate per kw. hour, between 2 in. and 1 in. absolute back pressure in condenser.

10 lb. steam pressure equals 1 per cent in water rate per kw hour. It was agreed that the steam pressure under test conditions would not vary more than 5 per cent from 175 lb.

12½ degrees F. was agreed to equal 1 per cent in water rate per kw. hour. It was agreed that under test conditions the superheat would not vary more than 25 per cent from 100 degrees F. It was subsequently agreed under excessive superheat of test to allow 14 degrees F. equal 1 per cent in water rate per kw. hour.

From the results of the test, the data of which is herewith appended, it was found that for a 10,000 kw. load the water consumption was 14.7 lb. per kw. hour and for the 12,000 kw. load it proved to be but 13.87 lb. per kw. hour.



15,000 kw. Curtis Turbine at Station A.

The new turbine unit has the condenser installed in its base and hence in this respect differs from the former 9000 kw. installation at this station. In the condenser, are to be found 5600 tubes each 17 ft. 2 in. long, comprising a journey of over 18 miles for the water in passing through the condenser. 25,000 gallons per minute or 36,000,000 per day constitute the necessary circulating water supply. Oakland, Alameda and Berkeley use only 19,000,000 gallons of water per day, hence it is seen that this turbine alone uses a greater supply than all three cities combined for their municipal use.

The turbine operates at 720 revolutions per minute and generates at 4150 volts, 60 cycle, supplying three-

[1]A paper read before the San Francisco Section of A. I. E. E., March 29, 1912.

Turbine Test Data.

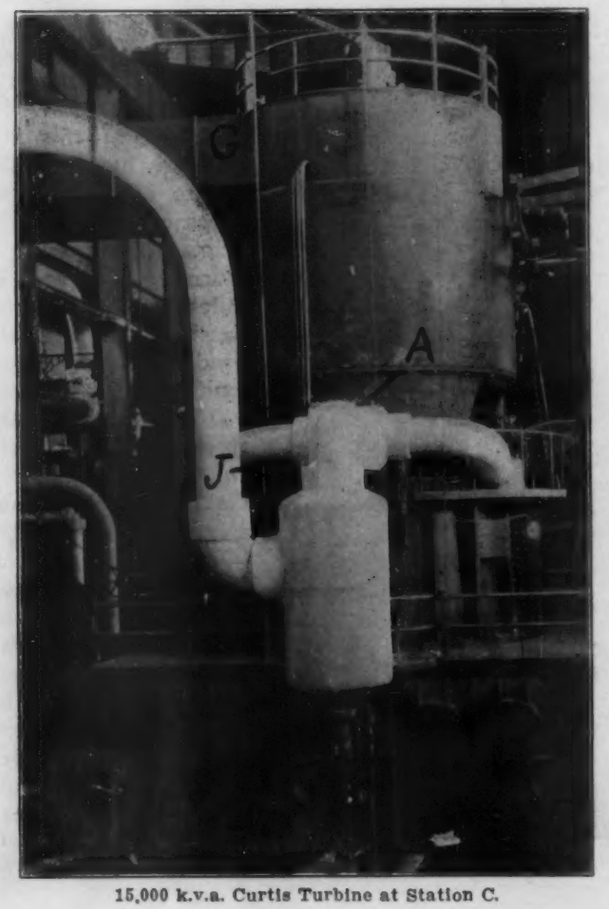
		10000 k.w. Load	12000 k.w. Load
CORRECTION FOR STEAM PRESSURE			
Pressure during test	lbs	171.5	166.4
Correction for gauge error, add.	lbs	1.0	1.01
Corrected pressure	lbs	172.5	167.4
Guarantee based on	lbs	175.0	175.0
Test pressure (low)	lbs	2.5	7.6 "
From contract, 10# pressure equals 1% in water rate.			
Correction pressure factor for steam pressure		0.25%	0.76%
CORRECTION FOR STEAM TEMPERATURE.			
Temperature during test	deg	521.20	538.8
Correction for stem exposure	deg	5.65	5.99
Corrected temperature during test.	deg	526.85	544.79
Absolute pressure during test	lbs	187.20	182.
Temperature at test pressure	deg	376.20	373.90
Superheat during test	deg	150.65	170.89
Guarantee based on superheat of	deg	100.00	100.00
Superheat during test (high)	deg	50.65	70.89
14 deg. Fah. Superheat equals 1% in water rate.			
Correction factor for temperature	%	3.62%	5.06%
CORRECTION FOR VACUUM			
Average vacuum during test corrected	in.	28.229	28.02
Guarantee based on	in.	28.500	28.50
Vacuum during test (low)	in.	0.271	0.48
From contract 1" absolute back pressure equals 1# in water rate.			
Correction factor for vacuum	lbs	0.271	0.48
SUMMARY			
Total lbs. of water weighed	lbs	559823.	673910.
Scale #1 - 3/4 lb. high 86 lbs.			
Scale #2 - 1/2 lb. high 86 lbs	lbs	144.	144.
Total water	lbs	559479.	673766.
Total K.W. output	lbs	40320.	48925.
Uncorrected water rate (Gross)	lbs	13.876	13.771
Correction for steam pressure. sub. 0.25%	lbs	0.034	0.104 +
" 0.76%			
Correction for steam temperature + 5.06%	lbs	.502 +	0.698
" 3.62%			
Correction for vacuum, subtract 0.49	lbs	0.271	0.490
Total corrections, add	lbs	.197	0.102
Corrected water rate	lbs	14.073	13.873

Boiler Test Data.

1. Date of test		Feb.24,12	Feb.28, 12
2. Duration of test		8 hours	8 hours
3. Type of burner		Internal Mixer	
4. Make of burner		Staple-Pfeiffer	Owens
5. Number of burners used		4	4
6. Water-heating surface	sq.ft.	7254.	7254.
7. Superheating surface	sq.ft.	116.	116.
AVERAGE PRESSURE			
8. Barometer	inches	30.20	30.31
9. Steam pressure by gauge (saturated)	lbs.sq.in.	186.3	194.1
10. Oil pressure at burner	lbs.sq.in.	50.4	123.
11. Force of draft in breeching	ins. water	.55	.69
12. Force of draft before damper	ins. water	.34	.49
13. Force of draft in furnace (near supt)	ins. water	.06	.05
14. Force of draft in ash pit	ins. water	.06	.08
AVERAGE TEMPERATURES			
15. External air	degrees F.	57°	54°
16. Fire room	degrees F.	84°	77°
17. Air entering ash pit	degrees F.	84°	77°
18. Escaping gases from boiler	degrees F.	370°	440°
19. Oil at burner	degrees F.	96°	90°
20. Feed water entering boiler	degrees F.	169.1°	174.1°
21. Superheated steam	degrees F.	527°	536.9°
22. Saturated steam before superheater due to pressure	degrees F.	381.9°	385.6°
23. Degrees of superheat	degrees F.	145.1°	151.3°
FUEL			
24. Kind Cal.Crude-Asso Oil Co. fuel oil)		crude	fuel oil
25. Gravity of oil at 60° F.	specific	.9705	.9705
26. Gravity of oil at 60° F.	deg.Beaume	14.32	14.32
27. Percentage of water in the oil	per cent	.7 of 1%	.6 of 1%
28. Calorific value of dry oil per lb.	B.t.u.	18758.	18752.
29. Weight of oil as fired	lbs	15084.	15115.
30. Weight of oil consumed corrected for moisture	lbs	14976.	15039.
FUEL: AVERAGE PER HOUR			
31. Oil consumed per hour as fired	lbs	1885.5	3023.
32. Oil consumed per hour corrected for moisture	lbs	1872.	3008.
33. Oil per hour corrected for moisture per cu. ft. of furnace volume	lbs	1.756	2.82
34. Oil per hour corrected for moisture per sq.ft. of heating surface	lbs	.258	.415
WATER			
35. Total weight of water fed to boiler	lbs	805277.	199077.
36. Factor of evaporation		1.178	1.177
37. Equivalent evaporation from & at 212°	lbs	241816.	234316.
WATER: AVERAGE PER HOUR			
38. Water evaporated per hour	lbs	25659.	39915.
39. Equivalent evaporation from & at 212°	lbs	30227.	46963.
40. Equivalent evaporation from & at 212° per sq. ft. of water heating surface	lbs	4.17	6.46
HORSE POWER			
41. Horse power developed A.S.M.E. rating	H.P.	876.	1378.
42. Builders' rated horse power	H.P.	773.	773.
43. Percentage of builders' rating developed	%	113.3%	178.7%
ECONOMIC RESULTS			
44. Water apparently evaporated under actual conditions per pound of oil as fired	lbs	13.61	13.17
45. Equivalent evaporation from & at 212° per pound of oil as fired	lbs	16.03	15.5
46. Equivalent evaporation from & at 212° per pound of oil corrected for moisture	lbs	16.14	15.58
EFFICIENCY			
47. Efficiency of the boiler	%	83.63	80.82
ANALYSIS OF THE DRY GASES BY VOLUME			
48. Sample taken where gases leave 1st & enter 2nd pass			
49. Carbon dioxide (CO_2)	%	14.3	14.9

phase alternating current. Its base dimensions are 17 ft. 6 in. long and 17 ft. wide and has a height of 33 ft. 4 in. The outer edge of the disk travels at the rate of 400 ft. per second or 6545 miles a day.

In cooling the generating windings, 50,000 cu. ft. of fresh air per minute are required and this is supplied through the steel duct shown above the turbine to the left. The rotating part of the turbine weighs 75 tons, its total weight being 320 tons.



15,000 k.v.a. Curtis Turbine at Station C.

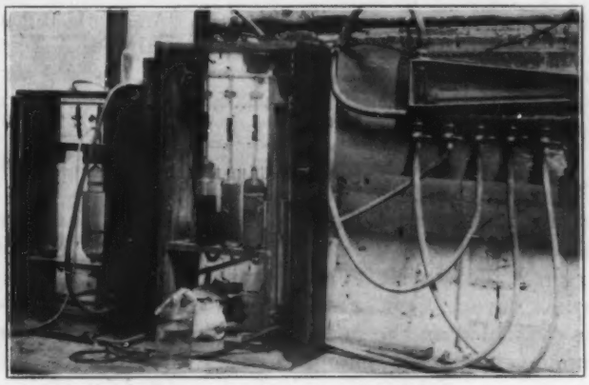
Boilers.

The turbine is supplied with steam from four 773 h.p. water tube boilers of the Parker type. Each boiler contains 366 four-inch tubes 20 ft. long. The total heating surface per boiler is 7734 sq. ft. with a grate surface of 48 sq. ft.

The boilers were guaranteed, under conditions of sale, to evaporate 15½ lb. of water per lb. of oil. The oil was to be on a calorific basis of 18,500 B.t.u. per lb., and the evaporation of the boiler water from and at 212° F. The boilers are also guaranteed to stand an overload of 60 per cent on their builder's rating without sending forth chimney gases at a temperature of above 600° F. All of these limits were well met. Under test the boilers evaporated 13.61 lb. of water per lb. of oil. The oil analyzed 18,752 B.t.u. per lb. Hence 16.14 lb. of water was evaporated per lb. of oil on the basis of 18,500 B.t.u. per lb. The efficiency, hence, exceeded 83½ per cent. As to overload conditions, 75 per cent overload was maintained for five hours

with an efficiency above 80 per cent and with chimney gases below 15 per cent CO_2.

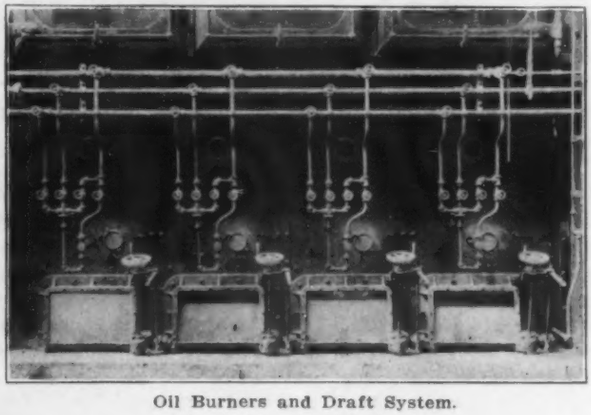
The design of the air draft admission gates to the boiler furnace is unique and of high efficiency. As shown in the illustration, wheels attached to worm gears operate the draft openings and thus the draft can be regulated to the minutest detail. In the performance of the efficiency test the careful manipulation of these gates aided greatly in securing the best conditions of operation. The closing of the damper doors tends to bring the air towards the tip of the burner.



Orsat Apparatus and Draft Gauges.

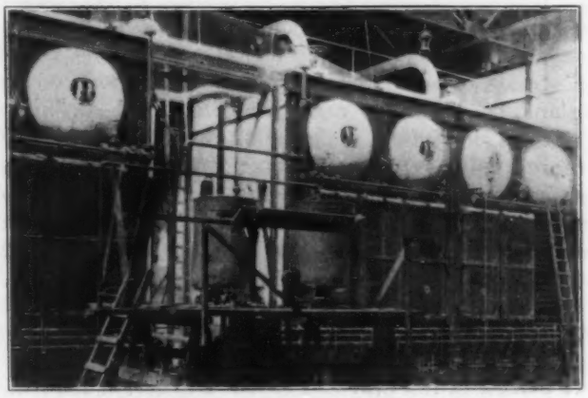
The condenser is of the Worthington two-stage type and contains 25,000 sq. ft. of cooling surface. It is situated in the base of the turbine and the circulating water enters toward the center and divides outwardly returning by two separate mains. The feed water heater is of the Wheeler vertical closed type and has 2000 sq. ft. of heating surface.

The accumulator, manufactured by R. D. Wood & Company has a 11½ in. by 14 ft. horizontal stroke. It is of the accumulator tank ballast type and is capable of developing 1150 lb. per sq. in. working pressure and actually delivers 950 lb. per sq. in. to the step bearings. This accumulator is held in reserve for the two turbines above referred to. The oil tank filter is of the Turner type and is 12 ft. 3 in. by 4 ft. with a height of 5 ft. The condenser discharges into a steel hot well tank 10 x 6 x 5 ft. The dry vacuum pump is of the rotative type and manufactured by Laidlaw-Dunn-Gordon Company. The size of the cylinders are 14 x 39 x 30 in.



Oil Burners and Draft System.

A Byron-Jackson circulating pump with a capacity of 40,000 gallons per minute performs the function of supplying the condenser with water. The circulating pump engine has a cylinder of 16 x 27 x 35 in. and is manufactured by the American Engine Company. The exciter used for the new turbine is of 125 kw. capacity and of the Curtis vertical turbo-exciter type. The Alberger Pump Company supplied the four-stage turbine pump for the feed water. The hot well pumps used to lift the water from the condenser into the hot well is of the Worthington turbine driven two-stage type and is motor driven. Two Dean pumps 12x2⅞x12 in. are used to supply the high pressure for the step bearings, while two Dean pumps 5½ x 3¾ x 5 in. supply the pressure for the guide bearings. Two Snow pumps, 5¼ x 4¾ x 5 in., are used to secure the oil return. The new steel stacks are 125 ft. high with a diameter of 10 ft.



Water Weighing Apparatus and Parker Boilers.

The complete new equipment is now in full and successful operation and stands as a sentinel ready to safe-guard continuity of service at all times in case of a temporary shut down in the mountains of any of the hydroelectric plants of the Pacific Gas & Electric Company or in event of excessive peak load conditions developing at any time on the distributing system of the company.

TELEPHONE TROUBLES IN TACOMA.

The entire Pacific Coast seems rent with agitations at present over the absorption of the independent lines by the older and stronger corporation, owned by the Bell telephone interests. San Francisco had its innings last week when its citizens expressed themselves as overwhelmingly in favor of the taking over under municipal ownership of the independent telephone lines.

Now comes Tacoma with its troubles. Here we find last week the franchise of the Home Telephone Company giving it the right to maintain and operate a telephone system in the City of Tacoma was revoked by the City Council in legislative session.

This franchise is now held by the Sunset Telephone & Telegraph Company, which purchased the Home Telephone system at a Federal receiver's sale several months ago for $550,000.

The franchise of the Sunset Company will expire in 1915, while the franchise of the Home Company would have run until 1930.

WESTERN LAWS OF ELECTRICITY AND WATER

RIPARIAN RIGHTS IN THE WESTERN STATES

BY A. E. CHANDLER.

According to the common law doctrine of riparian rights in the law of waters, each owner along a stream was entitled to have the waters thereof flow in the natural channel, unpolluted in quality and undiminished in quantity. A strict interpretation of the doctrine would therefore forbid any use of the waters of the stream whatsoever. It was early modified in England so that two uses are recognized—ordinary or natural, including the use for domestic and stock purposes, and extraordinary or artificial, including the use for irrigation along the banks and also for mechanical purposes. For "ordinary" uses the upper riparian owner is allowed to take the entire stream if necessary; but for "extraordinary" uses he is entitled to water only when such use will not interfere with a like use by other riparian owners—that is, he must share the stream with others along its banks.

As shown in the previous paper, a different doctrine —that of appropriation—grew up during the early occupancy by the miners of the public domain in the Western States. It was also shown that the early California cases establishing the new doctrine were between parties not holding title to any land along the streams; and that the Supreme Court of Nevada in Van Sickle v. Haines (7 Nev. 249) and the Federal Circuit Court for Nevada in Union Mill & Mining Co. v. Ferris (2 Saw. 176) in 1872 held that in cases where title to riparian land had passed from the Government, the new doctrine must give way to the older and long recognized (in England and the Eastern States) doctrine of riparian rights.

The basis of the argument for the rule laid down in the two Nevada cases was a statutory provision making the common law of England the rule of decision in all the Nevada courts. It is important to note the following words of Chief Justice Lewis (in Van Sickle v. Haines) regarding the two doctrines, as they show an erroneous view of the doctrine of appropriation which, unfortunately, has been shared by the courts in many Western States:

"It (the common law) is a rule which gives the greatest right to the greatest number, authorizing each to make a reasonable use of it, providing he does no injury to the others equally entitled to it with himself; whilst the rule of prior appropriation here advocated would authorize the first person who might choose to make use of or divert a stream, to use or even waste the whole to the utter ruin of others who might wish it."

In marked contrast to the attitude of the Nevada courts in the early cases is that of the Colorado courts. In Coffin v. Left Hand Ditch Co., 6 Colo. 443, decided in 1882, the issue between riparian owners and appropriators was before the court for the first time. Coffin and others were riparian owners along the St. Vrain River, who, in the dry season of 1879, interfered with the ditch of the Ditch Company, which diverted the St. Vrain waters to another watershed. The company being a prior appropriator, Coffin relied upon his riparian right. The opinion is full of strong expressions showing the need of appropriation in an arid section, but a few concluding sentences only are given here:

"We conclude, then, that the common-law doctrine giving the riparian owner a right to the flow of water in its natural channel upon and over his lands, even though he makes no beneficial use thereof, is inapplicable to Colorado. Imperative necessity, unknown to the countries which gave it birth, compels the recognition of another doctrine in confiict therewith. And we hold that, in the absence of express statutes to the contrary, the first appropriator of water from a natural stream for a beneficial purpose has, with the qualifications contained in the constitution, a prior right thereto to the extent of such appropriation."

In the late seventies the case of Jones v. Adams, (19 Nev. 78), arose out of conflict over the waters of Sierra Creek, which, like Daggett Creek of the Van Sickle case, is a small Sierra creek in the west side of Carson Valley in Nevada. It was decided by the Supreme Court of Nevada in 1885 and the Van Sickle case was overruled on the ground that the doctrines of the common law were inapplicable "to the wants and necessities of the people, whether engaged in mining, agricultural or other pursuits." The doctrine of riparian rights was thus excluded from the law of waters in Nevada and has so remained.

The year following the decision in Jones v. Adams, the Supreme Court of California decided the celebrated case of Lux v. Haggin (69 Cal. 255). The extreme length of the opinion (two hundred pages—probably the longest in the California reports) is sufficient evidence of its importance and the interest in the issue involved. Lux and others sought to stop Haggin from diverting the waters of Kern River which would naturally flow down Buena Vista Slough, to which their lands were riparian. As in the Van Sickle case, the court had a wrong impression of appropriation and stated " . . . It does not require a prophetic vision to anticipate that the adoption of the rule, so called, of 'appropriation' would result in a monopoly of all the waters of the state by comparatively few individuals. . . ."

The riparian doctrine as modified in Lux v. Haggin is commonly called the California rule. Its principles, so often quoted, are best given in the words of the court:

"By the common law the right of the riparian proprietor to the flow of the stream is inseparably annexed to the soil, anl passes with it, not as an easement or appurtenance, but as part and parcel of it. Use does not create the right, and disuse cannot destroy or suspend it. The right in each extends to the natural and usual flow of all the water, unless where the quantity has been diminished as a consequence of the reasonable application of it by other riparian owners for purposes hereafter to be mentioned.

"By our law the riparian proprietors are entitled to a reasonable use of the waters of the stream for the purpose of irrigation. What is such reasonable use is a question of fact, and dcpends upon the circumstances appearing in each particular case. . . . "

Lux v. Haggin was decided by a divided court of four to three. It has not only fastened the rule of riparian rights upon California, seemingly for all time, but have been the main reliance of the other western states following the California rule. The following

extract from the dissenting opinion of Justice Ross shows how decided was the difference of opinion among the Justices:

"The common-law doctrine of riparian rights being wholly inconsistent with and antagonistic to that of appropriation, it necessarily follows that when the federal and state governments assented to, recognized, and confirmed, with respect to the waters upon the public lands, the doctrine of appropriation, they in effect declared that that of riparian rights did not apply. The doctrine of appropriation thus established was not a temporary thing, to exist only until some one should obtain a certificate or patent for forty acres or some other subdivision of the public land bordering on the river or other stream of water. It was, as has been said, born of the necessities of the country and its people, was the growth of years, permanent in its character, and fixed the *status* of water rights with respect to public lands."

The California rule has been adopted in California, Kansas, Montana, Nebraska, North Dakota, Oklahoma, Oregon, South Dakota, Texas and Washington. Parts of each of the states named are so humid that irrigation is not only not necessary, but there is a demand for drainage. In the remainder of the irrigation states—Arizona, Colorado, Idaho, Nevada, New Mexico, Utah and Wyoming—the doctrine of riparian rights has been abrogated and the so-called Colorado rule followed; that is, the doctrine of appropriation exclusively. It may assist one to remember the above classification by noting that the semi-arid or "border" states (that is, bordering the irrigation zone) follow the Caliornia rule, and that the strictly arid or "interior" states (that is, well within the irrigation zone) follow the Colorado rule.

One often hears the remark that there is no real conflict between the doctrines in California to-day, and it many times comes from a supposedly reliable source. Even the Supreme Court of Nevada in a recent case, Twaddle v. Winters (29 Nev. 88) decided in 1906, in speaking of the passing of the doctrine of riparian rights, quoted with approval the testimony of a California Congressman in the case of Kansas v. Colorado, in which he said "that there had been a departure from the principles laid down in Lux v. Haggin, because at that time the value of water was not realized; that the decision had been practically reversed by the same court on subsequent occasions, and that the doctrine of prior appropriation and the application of water to a beneficial use is in effect in force now in that state."

The above statement is entirely misleading, as the California Supreme Court has not only not departed from its position in Lux v. Haggin, but has within the past few years handed down opinions which almost nullify the doctrine of appropriation under certain physical conditions.

While the Nevada Supreme Court was writing its opinion in Twaddle v. Winters, the case of Miller & Lux v. Madera Canal Co., (155 Cal. 59) was before the California Supreme Court. It was finally decided in January, 1909. Miller & Lux as riparian owner along the lower Fresno River sought to enjoin the Madera Canal Company from diverting the flood waters thereof for storage in reservoirs. The Fresno River drains only the lower mountain area and is therefore dry early in the summer. The canal company is the owner of a system of ditches for the lands in the vicinity of Madera and intended to make use of certain natural depressions as reservoirs so that the flood waters of May and early June might be stored for use later in the season. The river banks through the Miller & Lux property are so low that the floods annually overflow them and deposit "on such lands large quantities of fertilizing and enriching materials, increasing their productiveness and enhancing their value."

The canal company argued that it intended to divert and store only the flood waters which could not be considered part of the natural flow to which riparian owners were entitled, and that the use, if such it could be called, of the flood waters by Miller & Lux was too wasteful and unreasonable to be tolerated. The Court refused to accept this argument in the following language:

"What the riparian proprietor is entitled to as against non-riparian takers is the ordinary and usual flow of the stream. There is no good reason for saying that the greatly increased flow following the annually recurring fall of rain and melting of snow in the region about the head of the stream is any less usual or ordinary than the much diminished flow which comes after the rains and the melted snows have run off."

"The doctrine that a riparian owner is limited to a reasonable use of the water applies only as between different riparian proprietors. As against an appropriator who seeks to divert water to non-riparian lands, the riparian owner is entitled to restrain any diversion which will deprive him of the customary flow of water which is or may be beneficial to his land. He is not liimted by any measure of reasonableness."

A case even more bewildering to appropriators, if possible, was that of Miller v. Bay Cities Water Company, decided one year later—February, 1910. Miller was the owner of a small orchard in the Santa Clara Valley and had for years irrigated it by pumping from a well. The water company intended to construct a dam to bed rock across the "lower gorge" of the Coyote River and thus impound the flood waters of the stream for diversion to San Francisco or other bay cities. Below the lower gorge the river flows through Santa Clara Valley to San Francisco Bay, so that no lower storage is possible. Miller claimed that the dam would prevent the underground waters from reaching the water bearing stratum tapped by his well and sought an injunction.

The Supreme Court sustained the finding of the lower court that the water bearing stratum below Miller's land has its "intake" in the vast bed of gravel in the lower gorge and is supplied by the surface and subsurface waters of the Coyote River flowing through said gorge. It accordingly affirmed the decree perpetually enjoining the water company "from arresting or obstructing at or above the lower gorge (except for the reasonable use thereof on the lands of said corporation in the exercise of its riparian rights) any of the water of the Coyote River which, excepting for said arresting or diverting, would flow on the surface of the bed of said river through said gorge, or would flow or percolate through said gorge underneath the surface thereof."

In a later article it will be shown that the owners of land overlying a water bearing stratum are treated in California as riparian owners, so the Supreme Court held that the water company was properly restrained from diverting to non-riparian lands the water which would flow through the stratum tapped by Miller's

well. The water company insisted "that if the plaintiff has a right to enjoin the diversion of the waters of the stream which would otherwise percolate to and supply the artesian stratum underlying his land, the court was not warranted in enjoining the appellants from diverting the flood waters of the Coyote River, which it was claimed were wasted and lost in the bay of San Francisco."

Regarding this argument the Supreme Court said:

"All these waters are necessary, of themselves or by their force, to supply underground waters, which they, even now, fail to do to the full capacity of the underlying strata, to which full capacity the plaintiff and others interested in them are entitled. . . . We are not prepared to say that, even in their flow after passing the gravels in which the intake to these artesian strata lie, they serve no other useful purpose, but certainly these storm waters do not become waste until they have flowed over these gravel beds and are on their way to the bay. It is only there that it may be said that they can perform no further useful service, the only place where they first become waste waters, and where, without apparently invading the rights of anyone they may be diverted. No reasonable objection could be made to the diversion of the waters there because they are then, for all practical purposes, waste waters."

The above ruling seems to establish so wasteful a policy that Justice Shaw wrote a concurring opinion and clearly presented the dire need of storage of our flood waters, showing the accomplishment of the triple purpose of lessening damage by overflow, affording irrigation water during the dry season and, through return waters from increased irrigation, bettering navigation during the low water period. He held, however, that the conditions in the Santa Clara Valley are not paralleled elsewhere in the State, except it may be in the San Fernando valley, and call for the rule laid down; that the floods when waste occurs are infrequent and such waste small and practically indeterminable; that the storage at chance intervals of such small quantities, subject to heavy evaporation losses, would be of little value; and that granting permission to store such waste while conferring no substantial benefit upon the water company would lessen the value of the valley property overlying the water bearing stratum.

The two cases above discussed are of particular interest as the era of reservoir building in the states recognizing the riparian doctrine is just beginning. The point to be remembered is that each case deals with such conditions that the court believes actual damage would be done if storage was allowed. This is emphasized in the recent case of Miller & Lux v. Fresno Flume Co. (158 Cal. 626), decided November 22, 1910. wherein the plaintiff sought to have enjoined the maintenance of defendant's dam and its alleged interference with the natural flow of Stevenson Creek, a tributary of the San Joaquin River.

Plaintiffs quote many California cases "as establishing the proposition that the riparian owner is entitled to the unobstructed flow of a stream at all times, including flood waters . . . . . and that, without regard to damage, it is the right of every riparian proprietor to have the water come to his land through its natural channel, undiminished in quantity and unimpaired in quality, save to the extent that results from reasonable use of the water by other riparian owners upon the stream."

In answer to this argument the court says:

"But the cases do not support the position which appellants take. Even if at common law or under the civil law it was a part of the usufructuary right of the riparian owner to have the water flow by for no purpose other than to afford him pleasure in its prospect, such is not the rule of decision in this state. . . .

It will be found, therefore, that the decisions of this state not only do not deny the right to the use of storm and flood waters, but encourage the impounding and distribution of those waters wherever it may be done without substantial damage to the existing rights of owners."

The court continues:

"In Miller v. Bay Cities Water Co., 157 Cal. 256 (107 Pac. 115), the principle is clearly recognized and declared that an appropriator of water may divert for use to any point beyond the watershed any portion of the waters of the stream which serves no useful purpose either to the riparian owners, or in supplying the underground stratum, or such waters as are in excess of the quantity necessary for such purposes";

And later in quoting from Miller & Lux v. Madera Canal Company, states,

"That our cases 'decide that an injunction restraining the diversion of storm or flood waters will not be granted at the instance of a riparian owner, when it appears that he will not be injured in any way by such diversion.'"

It is finally concluded that if the doctrine laid down in the earlier cases confers such rights upon riparian owners as claimed by plaintiffs, then such earlier cases may be considered modifled by the later decisions. It is shown in the closing part of this opinion that both parties are really riparian owners so that the relative rights of appropriators and riparian owners did not actually arise in the case. The language used has therefore the force of a dictum only, but as it was accepted by an undivided court it will undoubtedly hold in such cases.

The conclusion that must be drawn from the above is that lower riparian owners may not only enjoin the diversion of the natural flow but may also enjoin the storage of even the flood waters if such storage will result in damage, either present or prospective. It is therefore of vital interest to know the limits of riparian lands and the general limitations which other states have placed upon the riparian doctrine. These subjects will be considered in the next article.

PROGRESS OF WATER RIGHT ADJUSTMENT IN OREGON.

In view of the interesting articles by A. E. Chandler now appearing in these columns on the subject of water rights, the following conclusions on water right laws of the State of Oregon, by John H. Lewis, State Engineer of Oregon, are given as they appeared in the Pacific Builder and Engineer. As Mr. Chandler was one of those who were instrumental in bringing about the new water right conditions in Oregon, added interest attaches.

The doctrine of beneficial use was taken as the basis for the Oregon system of titles. The recent law of 1909 rests primarily upon the declaration that "all waters within the State from all sources of water supply belong to the public," and that the State through its police power is charged with the administration of this property in such a way as to promote the peace and safety of its citizens.

To administer this property a board was created composed of the State Engineer and the superintendent of each of the two divisions into which the State was divided. While certain specific duties are assigned to the different members of this board, the responsibility of determining old rights, the granting of new rights, and the protection of all rights when determined requires action of these officers sitting as a board.

The systematic determination and recording of existing water rights is one of the important duties of this board. The task is comparable to the preparation of the Domesday Book by William the Conqueror, which was the first attempt in England to systematize land titles. This water record is the foundation for police regulations necessary for the protection of the individual user. It is the basis for computing the surplus water in a stream as a guide for new investments. It will also serve as a basis for the distribution of water, by the water masters, for the protection of new as well as of old rights.

The water code has now been in successful operation for three years, during which time no serious defects have developed. It appears to be giving general satisfaction to all concerned.

This law would never have been enacted but for the support of the commercial and other interests who are concerned only in the development of the State as a whole. It will take from five to ten years yet, and more liberal appropriations to complete the determination of all old rights, and to collect full information as to the State's water supply.

These same interests should continue their support and vigilance to see that this law is maintained upon the statute books for a sufficient length of time to give it a fair trial. To change the system at this or any other time is to undo all that has gone before. If at each session of the legislature some new system for recording deeds and mortgages was provided, it would lead to such confusion of titles to to destroy land values. Water right values in fully three-fourths of the State are of more importance than land values, It is, therefore, all the more important that the present system of water titles, which is based upon twenty years experience in Wyoming, should be given a thorough trial before any radical change is made.

So important is this matter that some State organization interested in the highest development of our water resources should undertake the preparation of a constitutional amendment which will more firmly establish the present system, and submit the same to a vote of the people. The adoption of such amendment would go far in restoring confidence. Until this is done the time of each legislature will be so fully consumed in defeating legislation proposed by enemies of the present system that much needed new legislation cannot be secured.

To the average settler the question of water titles and water measurements appear most complicated. It is no wonder that a few wildcat enterprises have caused such a lack of confidence among prospective purchasers of irrigated lands, as to make difficult the colonization of lands under legitimate enterprises. This lack of confidence has spread to the eastern bond markets, thus making it difficult to finance new enterprises.

With its model water law and a fair beginning in the collection of water data, Oregon is in the front rank of Western States for a speedy recovery from present unsatisfactory conditions. Now that the experimental stage is over, the people should not hesitate to make adequate appropriations for stream surveys, and for the determination of existing rights, so that our surplus water supply may be known. The public should fully appreciate the fact that future development will depend upon the collection of these data, and will be in proportion to the confidence of capital and the water users in the State's administrative system. Under the present law wildcat enterprises can in the future be prevented from imposing on the public if water supply data is available and sufficient funds provided for investigations by the State's administrative officers prior to the issuance of permits. When water maps and records are available and can be interpreted as definitely as land maps, confidence in all classes will be restored as to water projects, and not before.

WESTERN UNION PENSION PLAN.

The Pacific Coast executives of the Western Union Telegraph Company have received advices of the inauguration of a pension plan for the benefit of the 30,000 employees connected with that corporation throughout the United States. Announcement was made by President Theodore N. Vail as follows:

The plan in detail is as follows: Upon retirement, after 20 years of service and up to and including the twenty-fifth year of such service, the employee receives 1 per cent of the average salary for the ten years immediately preceding retirement multiplied by the total years of service. After 25 years of service and up to and including the thirty-fifth year of such service, 1½ per cent additional for each additional year. After 35 years of service and up to and including the fortieth year of such service, 2 per cent additional for each additional year. After 40 years, 50 per cent.

The minimum pension allowance to be $25 a month, except when otherwise directed. No pension under this plan will exceed $100 per month.

N. E. L. A. TOURS TO SEATTLE.

In connection with the 35th annual convention of the National Electric Light Association at Seattle, Wash., June 10-14, 1912, the transportation committee has arranged several special tours de luxe for Eastern delegates. Special trains will leave New York City and Boston on May 26, visiting en route Grand Canyon of Arizona, Southern California, San Francisco and Seattle, arriving June 9 and returning on June 14 by way of Portland, Yellowstone Park, Salt Lake City and Denver. Other special trains will leave New York and Chicago on June 4, by way of the Canadian Rockies, while specials will also be run from Chicago on June 6 and St. Louis on June 5. Beautiful booklets and other literature are being sent to all members so as to arrange for accommodations in advance. Special reduced fares have been given by the railroads.

TRADE RELATIONS IN THE ELECTRICAL INDUSTRY.

BY PHILIP S. DODD.

The question of trade relations between the central station, the jobber, the contractor and the manufacturer has been for many years much debated. While some relation along co-operative lines has been recognized as a vital necessity to the growth of the electrical industry, the point for debate has always been as to just what this co-operation could be and just what lines it should follow.

It is recognized that the central stations must, to a certain extent, take the initiative because of the fact that it is their current which will be used for the operation of all current consuming devices sold.

There are so many points to be considered and local conditions vary so greatly, that the question of co-operation along any line, must naturally be a question to be discussed locally, rather than as a national proposition. Either locally or nationally the question can logically, only be arrived at satisfactorily from one viewpoint,—"The greatest good to the greatest number"—and by the "greatest number" means not only the manufacturers, the central station and other distributors of energy and devices, but the public as a whole—the ultimate consumer of electrical energy and electrical products.

Admitting that the use of electrical energy through some form of current consuming devices, confers a benefit on the vast majority of the individuals who go to make up our population—the question is, how best to increase the uses of electricity and educate the masses to a fuller knowledge of the benefit that lies at their hands.

Considering the question from the viewpoint of industrial economies, it would seem that this education could be best handled through co-operative effort on the part of the various interests who are endeavoring to increase the sale of current consuming devices or electrical energy and as it clear that co-operation is only possible where each have equal opportunity for profit in proportion to investment or effort expended, it would appear necessary that the first step toward any practical move for development would be harmonization of the various allied, but sometimes warring interests.

Agreements must be reached and adhered to, as to the definite field of operation of each and arrangements made which will give to each a fair return, and an equal opportunity. Once this is accomplished the means for development of the market are many.

To the initiated, electricity is a simple servant, easy to handle and control, and always ready for work at a pull of the switch or a pressure of the button, but it must be remembered that to the greater majority of the public, it has been a thing of fear—a stupendous mystery and that increase in its use must come through education—education along the lines of safety, economy, healthfulness, readiness and sureness of service and the like.

Education is more vital to the increased use of electricity than to the marketing of any other commodity which is in general use by the public today. Efforts toward that education are being made in many directions and in many different ways. Through publicity work on the part of the various local organizations, such as the Jovial Luncheon Clubs, Lunch-Club branches of the National Electric Light Association company sections, Development Leagues, etc., and the effort that is being made by them in every progressive city, where it has not already been started, to publish co-operatively an electrical page in the newspapers. By their co-operation with boards of trade, chambers of commerce, to advertise and assist in the development of the city itself by the use of electric signs, improved street lighting, etc., etc., and in several cases where it has been successfully demonstrated that it is possible to arrange with school boards for the introducing of electrical courses in the schools and colleges.

The commercial section of the National Electric Light Association is doing a number of practical things for the development of the industry through the preparation and distribution by some of its committees of publications of educational value covering the wiring and lighting of homes, the lighting of factories, work shops, etc., the lighting of streets, sign lighting, etc., and by the dissemination among its members for use in their work with the public, of information pertaining to commercial practical selling methods, data relative to current consuming devices, power data, etc., etc. Its future plans include a cumulative index of the above together with a complete catalogue of current consuming devices and properly indexed digests or abstracts of articles of commercial interest appearing in the current technical papers.

All this work being co-operative not only on the part of the operating companies but by them with the manufacturers, the jobbers and contractors, is effecting the entire industry and is gradually but surely bringing about more harmonious relations among the different interests and settling day by day the question of trade relations which until only recently has stunted the growth of the business.

We are all learning,—the central station that real development comes only by the use of intelligent effort in educating the public and by active co-operation with the jobbers, contractors and manufacturers, and the jobber, contractor, and manufacturer that it is not only desirable but necessary that they co-operate with and secure the full co-operation of the central station.

The Commercial Section, the Jobbers' and Contractors' Association, the Jovian Order as a whole and through its local organizations and the various other local organizations are all working co-operatively among themselves and in many instances with each other towards practical concatenated effort for the development and betterment of the business as a whole, and while individual publicity is logical and valuable and will without doubt always be continued, the tendency is toward mutual effort for mutual good, not only along publicity lines, but in many other channels. The time is not far distant when this working together of the various interests will be settling quietly and naturally the differences which may appear difficult in the extreme to us all today.

SOLUTIONS OF THERMOTWISTERS.

The Indicator Card—Sixteenth Lecture.

BY J. F. POLLARD.

1. By reading up cross references on the indicator outline a series of rules of procedure in taking cards from the indicator.

Rule 1.—Procure an indicating device suitable to the type of engine which is to be tested. The Thompson indicator is one of the oldest and probably the best known. The Crosby indicator is well adapted to engines running at high speed (up to 400 r.p.m.) Other types of this class, such as the Taber and Star Brass "Navy Pattern" differ from the Crosby only in the method of producing straight line parallel motion of the pencil. For engines running more than 400 r.p.m. some form of optical indicator should be used. The subsequent rules will deal only with the Crosby indicator which is a common and a good type.

Rule 2.—Before using an indicator carefully clean all of the working parts, especially the piston. Next select a spring of such a scale that with the highest pressure to be recorded the height of card will not exceed about 1¾ in. Attach the spring in its proper position and after smearing a little cylinder oil in a thin coat on the working surface of the piston, replace the parts. Occasionally oil the moving parts of the pencil mechanism with watchmaker's or porpoise oil.

Rule 3.—Adjust the screw on the handle provided for moving the pencil so that when the latter is well sharpened a very fine line will be drawn.

Rule 4—Adjust the length of the indicator cord so that the drum will be neither too loose nor too tight; that is to say will not strike either of the stops when the engine is operating. The cord used should be selected with care since it must be of such quality as not to be stretched appreciably by the forces to which it is subjected.

Rule 5.—The atmospheric line should always be taken preferably after the diagram has been made. It is drawn after the indicator cock is closed. Always keep cock closed and cord detached from cross-head except when a card is to be taken. Do not allow the drum to snap back against the stop when the cord is unhooked.

Rule 6.—As soon as a card has been made it should be removed and examined. If any inexplicable irregularities in the lines or unaccountable differences in lengths or areas of different cards are noted a strenuous effort should be made to remedy the faults. (Enumeration of most general sources of error and suggestions for their remedy as given in problem 2 below.)

Rule 7.—After a test, the indicator should be removed immediately from the engine, protecting the hands with waste or thick gloves to prevent burns. All the parts, especially those in the cylinder, should be thoroughly cleaned and then put together again without the spring, which should be put away with the other springs in a box provided for the indicator. An indicator should never be handled by taking hold of the drum, as usually it is fastened to the indicator by only a loose slip joint and this comes off easily.

2. Make a list of all errors which frequently arise in the taking of indicator cards and devise cures or methods to avoid the same.

(1) Moyer states "About one-half the troubles with indicators in operation arise from loose springs, although probably not so frequently with the Thompson indicators as with some other types." The remedy for this is to take care to screw up the spring firmly against both the cap and the piston.

(2) Stretching of the indicator cord will cause the production of inaccurate cards. This can only be remedied by putting on a new cord of material that will not stretch under the tension to which it is to be subjected.

(3) Another frequent source of error is grit on the piston. This must be removed by taking out the piston cleaning it and lubricating it again with cylinder oil.

(4) Before replacing the piston and connecting parts in the cylinder it should be seen to that all the parts are connected firmly and without lost motion as this is another source of error in cards.

(5) Sometimes and particularly is this true in the case of gas engines, overheating of the piston will cause excessive friction which might be remedied by any of the common cylinder cooling devices, such as a coil carrying circulating water, a water jacket or in this case by simply arranging a small stream of water to flow over the outside of the cylinder.

(6) One of the causes of errors in results obtained with indicators not so readily detected is due to the pencil motion not being parallel to the direction of motion of the piston in the indicator. A simple test for this is to draw an atmospheric line on a card placed on the drum. The card should be at least as wide as the height of the drum. Then after taking out the spring raise the pencil to the full height of the card by pressing lightly on the piston. This operation may be repeated several times at different points along the length of the card. If the lines drawn are exactly perpendicular to the atmospheric lines there is no error in the pencil mechanism.

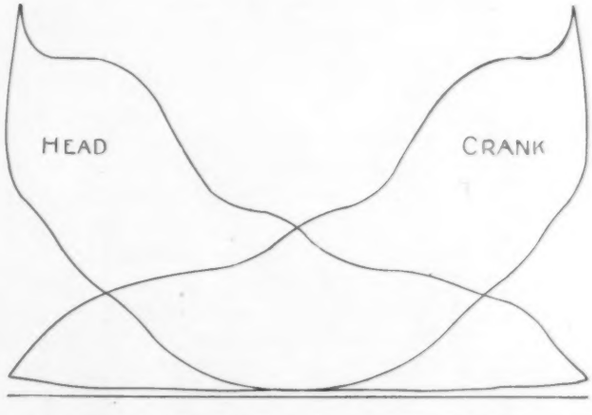
(7) Inexperienced testers often make the mistake of putting the spring and piston into place by merely slipping on the sleeve without screwing down the cap. Then, as a result, when the steam pressure is put on the indicator the piston, spring and pencil mechanism are thrown off with a great deal of force, and some of these expensive parts are sometimes completely demolished

References: "Applied Thermodynamics for Engineers," by W. D. Ennis, and "Power Plant Testing," by J. A. Moyer.

COMPUTATION OF IRREGULAR AREAS—EIGHTEENTH LECTURE.

BY E. H. ZEIFFUCHS.

1. Given the indicator cards of crank and head ends as shown below taken from a steam engine, compute the area by all six methods, thus satisfying yourself as to accuracy of each.

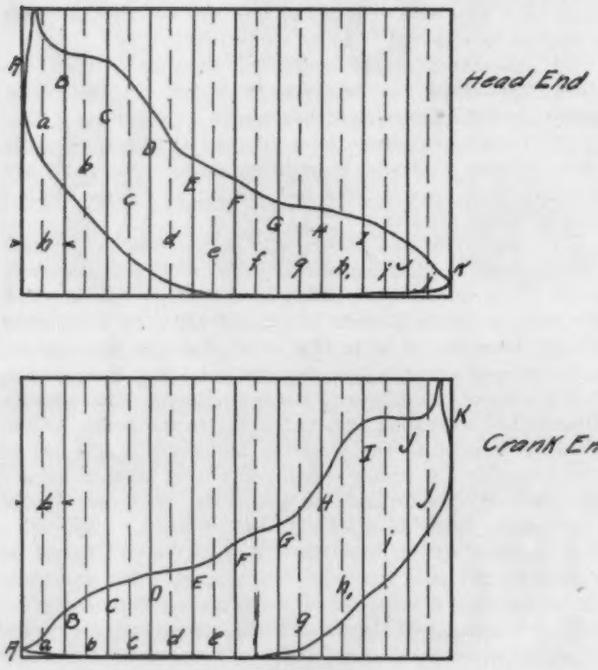


1st Method. By adding up the squares included in the diagrams.

Head End — 1735 sq. mm.
Crank End — 1650 sq. mm.
1 sq. mm. = 0.00155 sq. in.
Head End = 1735 × 0.00155 = **2.69** sq. in.
Crank End = 1700 × 0.00155 = **2.62** sq. in.

2d Method: Trapezoidal Method:

$$\text{Area} = h\left(\frac{A}{2} + B + C + D + E + F + G + H + I + J + \frac{K}{2}\right)$$



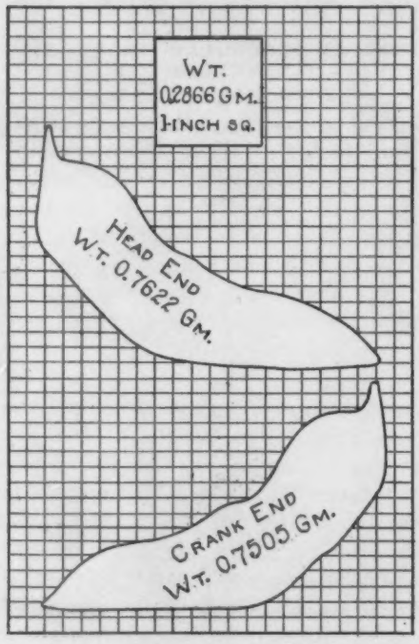
Method of Subdividing Card.

Head End

$$= 8.3\left(\frac{24}{2} + 27.2+33+30.2+25+22+18.2+16+14+\frac{20}{2}\right)$$

$= 8.3 \times 207.6 = 1687$ sq. mm.

$1687 \times 0.00155 = \mathbf{2.67}$ sq. in.



Areas by Weights.

Crank End

$$= 8.3\left(\frac{0}{2} + 9.5+14+16.5+17.5+23+25+30+33+26.5+\frac{20}{2}\right)$$

$8.3 \times 2050 \times 0.00155 = \mathbf{2.64}$ sq. in.

Third Method: Length of Lines Proportional to Areas:

Area = h (a+b+c+d+e+f+g+h+i+j)

Head End

$= 8.3\ (23.75+30.5+33+27.4+23+20+17.2+15+12+6)$

$= 8.3 \times 207.85 \times 0.00155 = \mathbf{2.67}$ sq. in.

Crank End

$= 8.3\ (5+12.5+15.6+16.8+19.3+25+26+33+31.5+18)$

$= 8.3 \times 207.2 \times 0.00155 = \mathbf{2.67}$ sq. in.

4th Method: By Weighing:

Head End, Area $= \dfrac{0.7622}{0.2866} = \mathbf{2.66}$ sq. in.

Crank End, Area $= \dfrac{0.7505}{0.2866} = \mathbf{2.62}$ sq. in.

Fifth Method: By Simpson's Rule:

$$\text{Area} = \frac{h}{3}(A+K)+4(B+D+F+G+H+J)+2(C+E+G+I)$$

Head End: Area under upper curve

$$= \frac{8.3}{3}(55+2.5)+4(47.5+35.5+22+16.5+11)$$

$$+2(45.2+26.5+18.2+14)$$

$= 2.765 \times 794.5 \times 0.00155 = 3.41$ sq. in.

Area under lower curve

$$= \frac{8.3}{3}(33+2.5)+4(20+5+0.5+0.5+.75)+2(12+1.75+0+0.5)$$

$= 171.0 \times 2.765 \times 0.00155 = 0.734$ sq. in.

3.41
.73

2.68 sq. in. H.E.

Crank End: Area under upper curve:

$$= \frac{8.3}{3}(2+55)+4(10+16.2+25.5+34.5+46.8)$$

$$+2(14+17.5+26+45.5)$$

$= 2.765 \times 783 \times 0.00155 = 3.36$ sq. in.

Area under lower curve

$$= \frac{8.3}{3}(2+55)+4(0+0+0+4.5+20)+2(0+0+0.5+12.2)$$

$= 2.765 \times 180.4 \times 0.00155 = 0.7725$

3.36
.77

2.59 sq. in. C.E.

6th Method: By Planimeter:

Head End: Reading of wheel at start.... 0.000
1st trial " " " " finish... 2.73
2d " " " " " " ... 5.41

Mean Reading, 2.70

Area = 2.70 sq. in. H.E.

Crank End: Reading of wheel at start.... 0.000
1st trial " " " " finish... 2.65
2d " " " " " " ... 5.30

Mean Reading, 2.65.

Area = 2.65 sq. in. C.E.

Summary.

	Areas. H.E.	C.E
Method Adding Squares.....	2.69 sq. in.	2.62 sq. in.
" Trapezoidal	2.67 " "	2.64 " "
" Lines Prop. Areas.....	2.67 " "	2.67 " "
" By Weighing	2.66 " "	2.62 " "
" Simpson's	2.68 " "	2.59 " "
" Planimeter	2.70 " "	2.65 " "
	16.07	15.79
	Head End.	Crank End.
Average Area of Six Methods...	2.68 sq. in.	2.64 sq. in.

THE STEEL TOWER TRANSMISSION LINE OF THE PORTLAND RAIWAY, LIGHT & POWER COMPANY.[1]

BY E. D. SEARING.

Early in 1911, the Portland Railway, Light & Power Company decided to construct a steel tower transmission line to deliver the power from the River Mill plant to Lincoln substation, in the city of Portland.

The River Mill plant was well under construction at that time and has, since, been placed in operation. It is a water power generating station on the Clackamas River, about three-quarters of a mile from the town of Estacada and near the way-station of River Mill, both on the Oregon Water Power & Railway line, an interurban electric railway owned by the company. The capacity of the plant is designed for an ultimate of 20,000 k.v.a. maximum. At present there are installed three 3667 k.v.a. alternators, generating at 11,000 volts, 60-cycles and stepping up through individual three-phase transformers, star connected, to 57,000 volts. The current at this latter voltage is delivered to the line through the usual busses, switches, etc.

Lincoln substation is the Portland terminal of the line and is situated near the foot of East Lincoln street. This point is in the Oregon Water Power & Railway freight yards and only a short distance from the main tracks. The substation contains apparatus, similar to that at the generating plant, for receiving the current at the line voltage and stepping it down to 11,000 volts, at which voltage it is distributed to the various parts of the city, through overhead, underground and submarine cables.

At the entrance of the line at both River Mill and Lincoln substation, aluminum electrolytic arresters are installed for protection to the apparatus against line disturbances. The lines are carried into the buildings through wall entrance bushings at the generating station and through roof entrance bushings at the substation.

The foregoing defines, in a general manner, the occasion for constructing the line, the voltage and the power to be transmitted, and the locations of the stations between which it extends.

From the River Mill plant, the course of the line runs for about half a mile, mostly across company property, to the right of way of the Oregon Water Power & Railway. From this point, it follows the right of way to Barton Station. Here, the survey leaves the right of way and crosses what is termed Barton, or Boring Hill, in a direct line to Sycamore station, again on the right of way. The line continues from this point, on the right of way, or company property, to Lincoln substation. As thus outlined the total length is 27.6 miles. With the exception of the portion proposed from Barton to Sycamore, the line is now constructed as originally contemplated. The survey over the hill extends through private property the entire distance and, on account of difficulties encountered in securing right of way, this portion is carried, temporarily, below another circuit on one of the wooden pole lines already constructed on the public highway. By deviating from the railway right of way, the line is thus made shorter by about five miles and avoids a number of long spans, stream crossings, sharp curves, and two villages.

The line is carried on steel supports for its entire length, except as noted previously. The standard support is a tower constructed entirely of galvanized materials, consisting of angles, channels, etc., bolted together. This structure is of a self-supporting, or inflexible, type and is designed to carry two power circuits of three conductors each, one telephone circuit of two wires and one ground wire. The circuits are in vertical planes on each side of the tower and 11 ft. apart. The conductors of each circuit are 6 ft. apart, suspended from three horizontal crossarms. The telephone wires will be in a horizontal plane 8 ft. below the lowest conductor, passing through the middle of the tower. The ground wire is 4 ft. above the upper crossarm and on the center line of the structure.

The tower is built up of four leg-angles, forming a base 12 ft. square at the ground and tapering to 3 ft. square at the lowest crossarm. From the lowest to the upper crossarm, the tower is of uniform cross section. Above this point, the angles converge to approximately 5 in. square to receive the cap casting for clamping the ground wire. The sizes of the leg angles vary from 3½ in. x 3½ in x ¼ in. at the ground to 2½ in. x 2½ in. x ¼ in. at the top. The main structure thus formed is braced and trussed in all directions by angles ranging from 1½ in. x 1½ in.x ⅛ in. to 2½ in x 2½ in. x ⅛ in. The crossarms each consist of two 4 in. channels with webs vertical, bent in such a manner that their ends meet and bolted to the sides of the tower at right angles to the line. The insulator support consists of a flat plate with a 1¼ in. hole for attaching the insulator, bolted between the ends of the crossarm channels. The lowest crossarm is 48 ft. from the ground, making the standard tower 64 ft. in height to ground wire clamp.

Where higher towers than the standard were necessary and for steep slopes, 10 ft., 20 ft. and hillside extensions were used. The 10 and 20 ft. extensions are constructed similar to the standard towers; they attach to the leg-angles at the bottom, have the same taper and make the total height of the tower 74 ft. or 84 ft. depending upon which is used. The hillside extension differs only in that it has two longer legs to be placed on the downhill side.

To facilitate climbing the towers, steps are provided on one corner, extending from a point 8 ft. above the ground to the lowest crossarm; they consist of 4 in. lengths of ½ in. gas pipe bolted to the angles by a bolt running lengthwise through the pipe. These steps alternate up the two sides of one of the corner angles, 18 in. apart. The towers are anchored by ground stubs consisting of an angle set into the ground and bolted to each leg; this angle having a shoe 2 ft. square made up of channels bolted together.

The standard towers each average 4100 lb. in weight and were fabricated in New York City. Before proceeding with the whole order, the manufacturer constructed a sample tower and subjected it to stated tests which were witnessed by a representative of the com-

[1]Paper presented before Portland Section, A. I. E. E., March 19, 1912.

pany. The test loads specified were: a pull of 12,500 lb. applied at the intersection of the middle crossarm and the center line of the tower; a pull of 4000 lb. applied at the ends of any two crossarms (aggregate pull, 8,000 lb.); a pull of 6,000 lb. applied at the end of any crossarm; all these in the horizontal and in the direction of the line; and a vertical load of 1500 lb. applied at the end of any cross arm. The tower was accepted on the basis of its withstanding these tests without distortion. The values for the loading were derived from an assumed maximum condition of 25 degrees F. below 0, one-half inch of ice all around the conductors, an indicated wind velocity of 70 miles per hour and with any two conductors broken.

The towers were received entirely "knocked down," the smaller members being wired together and the bolts boxed. Bundles and boxes contained parts for individual towers only. The larger members, bundles and boxes were marked so as to identify them in making up complete towers. The parts were distributed for assembling piece by piece, at the site of each tower. In all cases where space and conditions permitted, the towers were assembled on the ground and erected by a separate gang. They were arranged in assembling in a position so that when raised into the vertical, the legs would strike the holes for the ground stubs, the holes being left open until after the towers were erected.

The erecting was carried out by attaching a footboard, or "kicking plank," to the legs of the side resting on the ground, the plank being staked to keep it from kicking or sliding. A single gin pole was used for erecting, set in a hole about a foot in depth and sufficient distance in front of the tower to clear it when vertical. The pole was attached to the tower by a short hitch with it inclined back on the tower. The tackle rigged on the pole was anchored well ahead and back and side lines were attached to the tower while it was being raised; a two-horse team was used for pulling; when the tower reached nearly a vertical, the ground stubs standing free in the holes were attached to the two legs forward. The tower was then swung further until these legs took the weight off the "kicking plank." This was then detached, the other two stubs were bolted on, and the lines slacked off, allowing the tower to stand on all four legs. A separate crew finished the work of aligning the towers and backfilling the holes. Along the greater portion of the line completed, the towers were erected between existing high tension wooden pole lines. This, in connection with the cuts and fills for the road bed made it necessary to erect a number of towers, piece by piece, from the ground up. This operation proved too expensive to permit of erection in this manner where space was available for assembling with the towers lying on the ground.

The standard spacing of the towers on tangent is 500 ft. This spacing was varied from 150 ft. on curves to as high as 560 ft. in one instance where it was impossible to secure a location on the right of way otherwise. Care was used to locate towers near each public highway crossing in order to secure the maximum clearance below the lowest conductors.

The tracks of the Oregon Water Power & Railway follow regularly dedicated streets through the original townsite of Sellwood. The streets being public property and values placed on private property, made it necessary to employ special construction through this length; steel poles set just inside the curb line were used to meet this condition, they were manufactured in Portland and are ungalvanized; the main members consist of four main angles, latticed together with smaller ones; the tops are about 1 ft. square; the bases are 2½ ft. square at the ground and extend 8 ft. into the ground in a pedestal of concrete. The height and design of crossarms and ground wire clamps and vertical spacing of conductors and ground wire are identical with the towers. The horizontal spacing of conductors is 7 ft. instead of 11 ft. in the case of the towers. This lesser spacing between circuits was adopted on account of the normal spacing of poles being but 200 ft.

Carried at the extreme top of all the structures and held firmly in the clamp provided for that purpose, is a ⅜ in. seven-strand, extra galvanized, Siemens-Martin cable. Besides acting as a target for lightning and a patch, through its connection with the ground for the dissipation of overhead electrical disturbances, this wire serves to transmit to those adjacent and equalize any unusual strain occurring on any individual support. This wire, in addition to its connection to the ground through its contact with the metal of the structure, is also grounded at intervals of a mile through a copper wire soldered to it and carried down and soldered to a galvanized pipe into the ground.

The insulators used throughout are the single-piece unit suspension type. Each unit has a galvanized iron cap with a spherical socket, open on one side, and a short steel pin with a ball end. The cap and pin are both cemented to the single pieces of porcelain and the socket receives the ball-end of the pin of the next unit in the series. Three units are employed to make up a complete insulator in the suspended or vertical arrangement. Where insulators are used in a strain or horizontal position, four units are employed. No special strain towers or special strain insulators were used; however, to prevent creeping of the line, due to unusual stresses set up by temperature, winds and difference in elevation of supports, the conductors were dead ended at towers on an average of every two miles. The chain of units is suspended from the crossarm connection by a hook which also fits the socket in the insulator cap. The conductor is attached to the insulator by a clamp which grips the same securely.

Two styles of clamps were used, suspension and strain. The suspension clamp is designed to hold the wire in the hanging position and the strain clamp in the dead end or horizontal position. The clamps have clevises attached to sockets identical with those of the insulator caps. The insulator is easily assembled by slipping the ball and socket parts together. Cotter keys prevent the parts from disconnecting after they are installed.

The insulator, built up of units connected in this manner, makes a flexible combination, free to adjust itself to all conditions without internal torsional or bending stresses. The insulator units were shipped crated in sets of nine each, this being sufficient for three insulators as ordinarily used throughout the con-

struction. Each unit was tested before shipping at from 95,000 to 100,000 volts for dry flash-over, and at 4,000 lb. pull for mechanical strength. After the mechanical test, the insulators were again put through the potential test to check against any defects which may not have appeared in the first test or were developed by the mechanical stresses. These tests were made by a representative of the company, employed especially for this work.

As stated previously, the towers are constructed to support two circuits of three conductors each. The line, as at present installed, consists of one circuit, with the exception of the portion from the River Mill plant to the first intersection with the Oregon Water Power & Railway right of way. This length carries two circuits, one continuing to Lincoln substation, the other tieing-in with the pole line to Portland from the Cazadero plant, located further up the Clackamas River.

The conductors are 250,000 c.m. hard drawn, stranded copper and are calculated to transmit the entire output of the River Mill plant with less than a 10 per cent loss. These cables were received on reels carrying about 5500 ft. each. The stringing was performed by setting up the reels on "horses" and reeling off the cable, using a team to pull the cable off the reel and along the line. Hinged-side running blocks were attached to each crossarm on all the towers covered by the length being strung. The insulators were placed in position at the same time. The cables were then pulled up to the crossarms, one at a time, and placed in the running blocks by opening up the hinged side. The end being fast at the last tower strung, the cable was then pulled until the required sag was reached as shown by a table of spans, sags and temperatures furnished the stringing crew. By using the blocks, the cable adjusted itself to a uniform tension throughout the pull and assumed the natural sag for each span, automatically. The cable was then transferred from the blocks to the clamps attached to the insulators. The scheme of using the blocks and stringing, at about a mile to the pull, worked to such perfection that no trouble was experienced by insulators swinging out of plumb in the direction of the line, due to the accumulation of unequal tensions. The telephone circuit will not be installed for some time to follow.

The aggregate of materials required for the line is 310 standard towers, 32 10 foot extensions, 22 20 foot extensions, 17 Hillside extensions and 11 steel poles, total weight, 1,370,000 lb.; number of insulator units, 3750; weight of copper conductors, 350,000 lb.; weight of steel ground wire, 45,000 lb.

Serving a large power customer at Beaverton, is a branch line connecting with the main tower line near The Oaks Amusement Park. A 3-pole disconnecting switch supported on a separate standard tower is installed at his connecion. The branch line spans from the switch tower to a specially constructed steel tower 100 ft. high on the east bank of the Willamette River; thence to another similar tower 85 ft. high on the west bank and thence to wooden pole construction for the balance of its length. The span across the river is 1790 ft. and clears the mean low water level of the river under maximum loaded conditions about 80 ft. When thus loaded, the pull per conductor figures 14,000 lb. or an aggregate of 42,000 lb. at the top of each tower.

The design of transmission tower structures depends first, upon fundamental principles and thereafter, to a large degree upon data observed in connection with the tests on full size samples. The fact that a transmission tower is not expected to be absolutely rigid necessitates that other points be taken into consideration in the design besides theory. The amount of deflection permissable without its being permanent is high, many of the members are small, and, as a result, there is certain to be a reversal of stresses. The only method of determining the proper distribution of materials to resist these stresses is to observe the structure under actual stressed conditions.

The unit costs of this installation are not of value for comparison, on account of some of the more unusual conditions under which it was carried out. One of the most pronounced of these is the proximity to and resulting care necessary on account of existing high tension lines supply exceedingly important service. also, an exceptional number of crossings over lines of this character was necessary; difficulty was met in the character of the soil, a large percentage of the holes encountered sand and gravel, combined with water; others were in cemented gravel-and-boulder hard-pan and required blasting; as already noted, it was necessary to build up a number of towers complete from the ground; after practically all of the holes were dug and about one-third of the towers were still to be erected, unusual rains set in and it was necessary to redig a large number of the holes for these towers; special construction was necessary to avoid the purchase of property held at excessive prices; and the type of construction, on account of the size of conductors and the curves in the alignment, is unusually heavy. As a matter of interest, it may be noted that the total angle in the line amounts to approximately 900 degrees or 2½ complete circles, if angles are all of the same rotation. All of the foregoing conditions are not ordinarily encountered in a single parallel.

The line has been in operation for nearly five months. During this time, it has withstood one of the severest tests, which undoubtedly will ever be applied and this without permanent distress. The "silver thaw" of this year loaded the conductors to at least ten times the ice loads assumed in the calculated maximum conditions. Fortunately the maximum assumed temperature and wind stresses did not accompany this. Such a test would naturally be expected to develop all the defects in a line previously unstressed and this was the case. The trouble experienced was due to the slipping of one of the dead end clamps owing to only a portion of the bolts having been tightened, a result of poor execution in the field. This was sufficient to place the line out of service; however, the line was made inoperative either before or after the above occurred by a complete failure of the temporary connection over Barton Hill. Under normal conditions, the line has not experienced interruption to its operation, other than from the breaking of three units of one insulator and the trouble thus caused by the conductor dropping to the ground. The cause for the insulators breaking has not been determined, though it is thought to have been a bullet.

JOURNAL OF ELECTRICITY
POWER AND GAS

PUBLISHED WEEKLY BY THE
Technical Publishing Company
Rialto Building, San Francisco

E. B. STRONG, President and General Manager
A. H. HALLORAN, V. P. and Managing Editor
ROBERT SIBLEY, Treasurer and Editor in Chief
C. L. CORY, Secretary and Special Contributor
A. M. HUNT, Director and Special Contributor

On Library Cars of all Southern Pacific Trains.

TERMS OF SUBSCRIPTION

United States, Cuba and Mexico	per year.	$2.50
Dominion of Canada	"	3.50
Other Foreign Countries within the Postal Union	"	5.00
Single Copies, Current Month	each	.25

NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office *ten days in advance of date of issue.* New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

Entered as second-class matter at the San Francisco Post Office as "The Electrical Journal," July 1895.
Entry changed to "The Journal of Electricity," September, 1895.
Entry changed to "The Journal of Electricity, Power and Gas," August 15, 1899.
Entry changed May 1, 1906, to "The Journal of Electricity, Power and Gas." Weekly.

FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

CONTENTS

Turbine and Boiler Testing at Oakland 305
By Robert Sibley and R. F. Chevalier.

Telephone Troubles in Tacoma 307

Riparian Rights in the Western States 308
By A. E. Chandler.

Progress of Water Right Adjustment in Oregon 310

N. E. L. A. Seattle Tours 311

Western Union Pension Plans 311

Trade Relations in the Electrical Industry 312
By Philip S. Dodd.

Solutions of Thermotwisters 313

The Steel Tower Transmission Line of the Portland Railway Light & Power Company 315
By E. D. Searing.

Editorial 318
The Telephone Situation.
Frost Protection by Electrical Methods.
Engineering Ethics.

Personals 320

San Francisco Electrical Contractors' Notes 320

Electrical Development League 320

Trade Notes 320

Address to Jovians by Judge Debevoise 321

New Catalogues 321

Industrial 322
New Westinghouse Overspeed Limit Device.
The Increasing Use of the Telephone for Train Dispatching.
A New Pendent Switch.

News Notes 324

The Telephone Situation

Three weeks ago, although aware of a forthcoming special election looking toward the purchase of the independent telephone company by the municipality of San Francisco, although aware that the Public Service Commission would come into lawful supervision one week later, the Pacific Telephone & Telegraph Company absorbed the independent company at a reported price of nearly $10,000,000.

Many looked with favor upon the taking over of the independent company by the Pacific, provided a reasonable price was paid for such of the equipment held by the independent company as might prove useful under a combined system. The heedless manner in which the deal was consummated has had the tendency, however, to dull every human sympathy for either corporation. The citizens of San Francisco have just expressed their sentiment in no uncertain terms by overwhelmingly voting to issue bonds to purchase the independent company in spite of the strenuous efforts on the part of the San Francisco Chamber of Commerce to the contrary.

In the case of the taking over of the independent company by the older and stronger corporation the issue is clear. The independent corporation was well-known to be a doubtful investment from its incipiency. Money was nevertheless played upon this "wheel of fortune" and now that the venture has proved an unquestionable failure, let the speculators in this deal lose their money and not saddle upon the public an eternally interest bearing burden for this blunder.

It is rank injustice to expect the people to pay rentals for the service supplied over and beyond a reasonable return on the useful equipment purchased. Because a corporation has seen fit to effect an arrogant combination a week before the people could legally review the matter by an impartial commission, makes the issue devoid of sentiment or sympathy, and now, if this combination should prove legal, it behooves the commission to sanction the paying by the Pacific Telephone & Telegraph Company of the purchase price and at the same time to allow the corporation the delightful sensation of receiving a rate sufficient to pay a reasonable interest on a reasonable valuation of only the useful equipment, which the former independent company possessed. This is unquestionably far below the reported price involved in the purchase.

For the best interests of all, it is earnestly desired to bring about, in a businesslike manner, an adjustment of the present telephone situation. The ugly agitation now on in Tacoma, a brief of which is to be found on another page of this Journal, is indicative of the kind of public sentiment such overt acts on the part of an arrogant corporation invariably arouses.

Frost Protection by Electrical Methods

We live at the bottom of a great ocean of air. In this vast expanse of aerial sea, the same powerful forces of nature are at work in the formation of eddies, whirl-pools, and other turbulent phenomena are observed in the large oceans of water with which we are so familiar.

The fertile orchard lands of the West, being situated for the most part in mountain valleys, are vis-

ited by cold bodies of air, which slip down from the mountains above into the low valley bottoms. So subtle is nature in bringing about this slippage of cold air along the earth surface, that seldom do we find a freezing temperature at a point 15 to 20 feet above the orchard. Hence, considering a still night, that portion occupied by the tree and immediately surrounding it should be the only portion considered in the ideal heating of the orchard. In a word, the heating of 50,000 pounds of air per acre should suffice. To actually raise this amount of air five degrees in temperature requires only 50,000 x .24 x 5 or 60,000 B.t.u.

Although the present methods are effective in saving the orchard from a killing frost, it is interesting to note the enormous waste heat energies that take place. P. J. O'Gara, meteorological observer at Medford, Oregon, finds from careful tests that 750 B.t.u. are required per tree each minute to actually raise the temperature of the surrounding air five degrees. Assuming 70 trees to the acre, instead of 60,000 B.t.u. being necessary as a whole, we find that every hour are required 3,150,000 B.t.u. Since it is necessary to keep the protective oil fires in operation for several hours, it is easy to see to what enormous totals the B.t.u. consumption may reach. Such inefficiency is almost unbelievable, and yet even at this wasteful figure orchard heating is far within the range of economy in results produced, the saving of thousands of dollars in crops.

Since there is such a wide margin in economy to be accomplished by invention, it is not beyond human conception to believe that an electrical process may be devised in which the heat is carefully and scientifically applied at vulnerable points in the orchard, or a grill effect in the orchard produced, thereby causing the heated air currents to remain earth-bound instead of being carried away skyward. In fact, Professor Alexander G. McAdie of the U. S. Weather Service at San Francisco has definitely shown that a grill effect in an orchard can be produced by laying long strips of paper down the orchard rows, thus preventing heat radiation. If these coverings of paper are placed in the afternoon and removed later in the evening, it is found that an interflow of heat takes place between the air surrounding the strips of ground which did and those which did not have the covering.

A kilowatt hour of electrical energy consumed in orchard heating would evolve 3414 B.t.u. of heat per hour. The margin in economy is so great and the reward both for the inventor and for enormous power consumption contracts so sure and substantial, it is safe to say that another decade will not pass before electrical processes of some sort will be in general use.

As soon as the energetic power plant managers of the Coast appreciate fully the fact that one orchard in California spent over $4700 for successful frost protection last season, the immense application here offered will dawn upon them, and it is safe to say that the smile of happy realization—that smile from ear to ear which invariably appears when dividends and new business heave into view—will lead them to a thoughtful and careful investigation of the electric frost protection problem.

Engineering Ethics

In the last issue of the Journal, editorial comment was made upon the recently adopted code of ethics of the Pacific Coast Association of Consulting Engineers. The agitation looking toward a heightening of the ethical principle now in vogue in the employing of expert engineering witnesses in court trials is worthy of the staunchest support from all those having the interests of justice at heart. To illustrate the present procedure, we shall cite a prominent issue now at law in the Northwest.

Let us take as an illustration the usual procedure in the securing of expert witnesses in the case of damage suits. The Chicago, Milwaukee & St. Paul Railroad during the past few years, at an enormous expense, purchased a right-of-way through the Northwestern States suitable for its Pacific Coast extension. Of necessity, the line passes through many narrow valleys, fertile and prosperous. Natural water channels were changed in construction of the roadbed, but throughout the entire work the highest water levels known to the oldest residents were carefully studied, and proper allowance made in design. A neighboring railroad, the Northern Pacific, paralleling the proposed construction for scores of miles, had been in successful operation for twenty-five years. The records of this old and tried pioneer road were carefully reviewed and the best engineering talent available was utilized in checking up the new work, especially in matters of channel changes. In the spring of 1908, the road was finally completed. A reasonable amount of snow had fallen, and no unusual weather conditions could be foretold. However, in the latter part of May and early in June of that year, an unprecedented rainfall was experienced. Every high water mark known to the oldest inhabitant was submerged. Bridges and roadbed, with their expensive equipment, were all swept away in the narrow canyons of western Montana, causing hundreds of thousands of dollars in damage not alone to the railroad but also to farmers and dwellers along the line. The result was that the railroad found itself not only confronted with having to rebuild its road for many miles, but embarrassed with damage suits totaling almost an equal of expenditure.

In the heated legal battle that at once ensued, the country was scoured for engineering experts who were largely drawn from the territory through which the damage occurred. Today, though almost four years have now elapsed since the flood of 1908, the legal fight still continues. The individual cases are called from time to time, and the experts appear as witnesses for their respective sides, paid and retained by individual parties in interest.

Surely the employment by the court of thoroughly qualified engineers, having the sanction and approval of both parties to an issue, would not only put the consulting engineering profession above idle and hurtful criticism in the rendering of expert opinion, but would at the same time heighten immeasurably the accomplishment of justice, which, after all, is the fundamental excuse of existence for the courts themselves.

PERSONALS.

Ray Chapman has succeeded J. W. White as sales engineer with the Fort Wayne Electric Works at San Francisco.

H. A. Lardner, manager of J. G. White & Co.'s Pacific Coast department, has returned to San Francisco from Portland.

Fred S. Myrtle, head of the publicity department of the Pacific Gas & Electric Company, has returned from an inspection tour of the system.

R. H. Ballard, the secretary and assistant general manager of the Southern California Edison Company of Los Angeles is at San Francisco.

F. A. Richards, manager of the car department of Pierson, Roeding & Company, has returned to San Francisco after an extensive tour of the Pacific Northwest.

C. M. Clark, chairman of the board of directors of the Portland Railway, Light and Power Company, has returned to Philadelphia from an extended visit to Portland.

J. W. White has resigned as sales engineer with the Fort Wayne Electric Works at San Francisco to become vice-president and chief engineer of the Vix Engineering Company to become effective May 1.

W. S. Coleman now holds the positon in the San Francisco contract department of the Pacific Gas & Electric Company from which F. E. Cronise recently resigned in order to enter the office of N. W. Halsey & Co.

Wynn Meredith and R. S. Buck, who are the Pacific Coast members of the firm of Sanderson & Porter of New York, have returned to their San Francisco office after an extensive tour of Southern California and adjacent territory.

P. M. Hunt, of Hunt, Mirk & Co., is pushing the installation of the Tulare County Power Co.'s new steam-turbine electric power plant at Tulare. It is expected that current will be supplied to the new transmission line within the next two weeks.

R. B. Elder, district manager for several eastern electrical manufacturing companies, left during the past week for a month's tour of the factories, including those of the Ideal Electric Manufacturing Company, at Mansfield, Ohio, and the Moloney Electric Company at St. Louis.

P. M. Downing, engineer of operation and maintenance—hydraulic section—and A. L. Trowbridge, field engineer for the Pacific Gas & Electric Company, spent the past week out on the De Sabla system investigating the situation with a view to future betterments in the way of impounding dams, etc.

H. T. Cory, a consulting engineer of San Francisco, formerly of the Imperial Valley reclamation project, has left for Savannah, Ga., under urgent telegraphic call from the Flood Commission of Georgia in an attempt to solve the recent heavy flood problem along the Savannah River drainage.

A. W. Bullard and Walter S. Crandell were elected directors of the Great Western Power Company at the annual meeting this week, the latter representing the interests of the Edwin Hawley estate. Mortimer Fleishhacker was elected president and A. W. Bullard vice-president and general manager.

J. R. Wilson, sales manager of the Crocker-Wheeler Company of Ampere, N. J., has arrived at San Francisco with Mrs. Wilson on a tour of the Pacific Coast. He will make his headquarters for a few days with John S. Baker, the company's district manager, at 400-402 First National Bank Building.

Ralph L. Phelps, Pacific Coast manager for the Safety Insulated Wire and Cable Company, has returned to San Francisco from the San Joaquin Valley, where the San Joaquin Light and Power Company and associated companies were made agents for Safety Ruby Core Wire, which they have adopted and will handle exclusively.

D. C. Tuttle, formerly with the Stone & Webster Engineering Corporation of Boston, and more recently of the engineering department of the Spring Valley Water Company of San Francisco, has entered the firm of David Bixler & Company of San Francisco, as manager of the machinery department in charge of sales of their construction machinery and equipment in the States of California and Nevada.

W. R. Alberger, formerly vice-president of the traction systems in Oakland and surrounding territory, has been made vice-president and general manager of the new San Francisco-Oakland Terminal Railways. This is a consolidation of the San Francisco, Oakland & San Jose Railway, the East Shore & Suburban Railway and the California Railway. E. A. Heron is president of the executive department. Under the reorganization, J. P. Potter, formerly superintendent of the Oakland Traction and the Key Route, is now assistant to the general manager and head of the transportation department. E. E. Thornton, who was Potter's assistant, is superintendent of transportation. J. Q. Brown, the former chief engineer and purchasing agent, is now assistant to the general manager and chief of the mechanical and electrical department. Stephen F. Kieffer is director of engineering. In the mechanical and electrical department under J. Q. Brown, H. L. Griswold is engineer; H. P. Bell, assistant engineer, and H. Wickson, signal engineer.

ELECTRICAL DEVELOPMENT LEAGUE.

The Electrical Development League of San Francisco will meet at Tait's Cafe on April 9 at 12:15 p.m. Mr. Robt. M. Searle, vice-president and general manager of the Rochester Railway & Light Company, of Rochester, N. Y., will give a strong talk on ways and means of boosting the sale of electric current by means of concerted co-operative effort. All electrical men whether members or not, are invited to attend.

SAN FRANCISCO ELECTRICAL CONTRACTORS' NOTES.

The contract for Hale Bros.' new building on Market, near Fifth, has been let to McDonald and Kahro, general contractors.

The Fisher Electric Construction Company has been awarded the wiring on the building under construction at Third and Minna streets.

George W. Roberts, of Marysville and W. D. Thomas of Petaluma, are among the electrical contractors who arrived at San Francisco during the past week.

The Butte Engineering & Electric Company has been awarded the wiring on the apartment house on the corner of Franklin, Page and Market streets. The amount of the contract is $4000.

TRADE NOTES.

The Kellogg Switchboard & Supply Company has sold to the Rainier Telephone Company, of Rainier, Oregon, a complete central station equipment. A. L. Clark is president of the company.

The Pelton Water Wheel Company has been awarded a contract for the construction of two 18,600-h.p. Pelton-Francis turbines for the California-Oregon Power Company. This will be the largest turbine wheel ever built on the Pacific Coast. It will be installed at a new plant on the lower Klamath River operating under a head of 125 feet, being direct connected to a 3-phase generator.

A contract for the equipment of the United States cable station at Sitka, Alaska, with an electric power plant, has been awarded by Maj. D. J. Carr, of the United States signal corps, to the Western Electric Company, the lowest in a field of six bidders. The installation of a power plant at the Sitka station has been made necessary by the abandonment and dismantling at that place of the marine barracks, which formerly furnished the power to the Sitka station.

ADDRESS TO JOVIANS BY JUDGE DEBEVOISE.

A place for everything and everything in its place should have been the title of Judge Debevoise's talk to the New York Jovians on March 20th, for it was very much to this point in telling just what the relations of the various branches of the electrical industry, represented by the central station, the manufacturer, jobber and the contractor bore to each other. In his discussion of where the middle-man stood and of his value to the public, he used copper for his basis, and told just what hands or interests it passed through from the mines until it appeared as a useful part of some electrical device in useby the "man in the street," or rather the man or woman of the house.

Judge Debevoise spoke of the present government investigations and the efforts on the part of the government which would in the next few years tend to eliminate from any field the useless middle-man—the middle-man who did not render to the ultimate consumer a real service, or who did not in return for his profit give a service of value to the manufacturer in helping to distribute to the consumer more economically than the manufacturer could distribute himself.

In the electrical industry, he said that the various branches were or should be an unbroken chain, from the manufacturer to the jobber, and thence to the central station and contractor or small dealer, who dealt direct with the public—the first by its sale of current and the second by the sale direct to the public of appliances and various current-consuming devices.

Continuing further, he explained how very logical it appeared that the manufacturers should market their products through the numerous and well-placed jobbing houses, who were not only in a position to carry stocks, so that material could be economically and quickly delivered, but who could keep track of and carry local credits where the manufacturer could not, and who could also assist by bearing a certain proportion of the advertising and all the selling expense for these and many other reasons, the jobber did render an actual and valuable service to the manufacturer and his customer.

The contractor had also his position in the general scheme of things, he said, by distributing apparatus, etc., direct to the public, and by the fact that to the contractor logically belonged this part of the service, and also that of doing the wiring necessary to the sale of these appliances for distribution of the current for their use.

Clashes of these various interests had occurred and were occurring, he said, but through the Sons of Jove, the various local luncheon clubs and in many other ways they were all coming to meet and really know one another. Through their all honestly recognizing that where the line of demarcation was drawn as fine as it must be, in the electrical industry, and through open discussion and fair dealing and fair competition on the part of all, these differences were surely, though perhaps slowly, being eliminated.

Common sense would show any one the writing on the wall, which was clearly that individual prosperity could only come from the prosperity of all, and for the maximum prosperity it was necessary for all to work together. That the industry was awaking to the economic waste of absolutely individual effort was demonstrated by the appearance in fifteen different newspapers of a Co-operative Electrical Page —a page in which all local and some national interests co-operated for the education of the public as a whole to things electrical.

By this and by the formation and successful operation in many different parts of the country of Co-operative Jovian Luncheon Clubs, which brought the various interests together for joint discussion and work which tended toward the development of the industry, and in many other efforts which were being made toward real co-operative work, Mr. Debevoise said that the interests of the manufacturer, the central station, the jobber and the contractor was each coming more surely to take his place in the continuity of effort which would give to the public a perfect and an economic service, which together with the efforts toward greater education, was developing rapidly and more rapidly the growth of the industry and the prosperity of all.

The meeting closed with a report of F. E. Watts, New York Jovian statesman and chairman of the club, that the committee appointed to carry out the publication of the Co-operative Newspaper Page in New York, reported that they had already arranged with two of the papers as to the rates, etc., and that work had commenced for arranging for space with advertisers and that the committee hoped that in the course of a very few weeks that all the space in the two papers would have been contracted for.

NEW CATALOGUES.

Descriptive Leaflet 2440, issued by the Westinghouse Electric & Manufacturing Company, describes the Westinghouse split frame commutating pole railway motor 323A. This motor has a rating of 32 h.p. at 500 volts and 38 h.p. at 600 volts.

Catalog No. 406 from the H. W. Johns-Manville Company is a 300-page substantially bound book on "Noark" Enclosed Fuse Protective Devices. This catalog forms a particularly safe and logical ordering channel for those having to do with the protection of electrical circuits.

The American Eveready Company are distributing an attractive catalogue showing the construction and method of operation of Eveready Portable and Stationary Meters for direct current designed for charging stations, power plants, automobiles, motor boats and laboratory testing.

Catalog No. 408 from H. W. Johns-Manville Company, sole selling agents for I. P. Frink, is devoted to Modern Illumination for Insurance Companies and Banks. Illustrations are given of a number of actual installations and drawings are shown of the application of Frink reflectors to a large number of illuminating requirements.

The March issue of Small Motors, issued by the industrial and power department of the Westinghouse Electric & Manufacturing Company, is devoted to electric motor vehicle. Considerable valuable information is contained therein with reference to the operation of these vehicles and their production of revenue to the central station.

"A Central Station Prophecy Fulfilled" is the title of a neat booklet from the Electric Storage Battery Company. This is of peculiar interest to central stations as it shows the actualities of the electric vehicle as a desirable load and the tremendous increase in the sale of electrics.

The General Electric Company has just issued an attractive publication relative to electric heating and cooking appliances and their application to the home, office and factory. This bulletin, No. 4921, is printed in two colors on heavy coated stock, and has a very attractive embossed cover. Many of the various devices are shown in use. The publication contains also a section devoted to wiring plans and wiring devices for the home.

The General Electric Company has issued several new bulletins. No. 4929 is devoted to the application of electric motors to the operation of brick plants. In this bulletin is shown the electric motor as used in the various operations of brick manufacture. Bulletin No. 4940 illustrates and describes that company's latest development of the commutating pole motor, known as type DLC. No. 4928 is devoted to commercial searchlight projectors. This bulletin describes not only the carbon arc projectors, but contains also illustrations and description of the incandescent lamp searchlights just placed upon the market.

INDUSTRIAL

THE NEW WESTINGHOUSE OVERSPEED LIMIT DEVICE.

A new overspeed limit device for rotary converters and motor-generator sets has been developed and will be furnished on all Westinghouse rotary converters built in the future, and, when especially ordered, on motor generators. Fig. 1 shows the application of the new device to the end of a rotary converter shaft and Fig. 2 illustrates the details. Advantageous features of the new device include its positive action, few parts, rugged construction and compactness.

The operation of the mechanism will be apparent from a study of Fig. 2. Normally the trip lever is held in the position shown in full lines by the trip-spring.

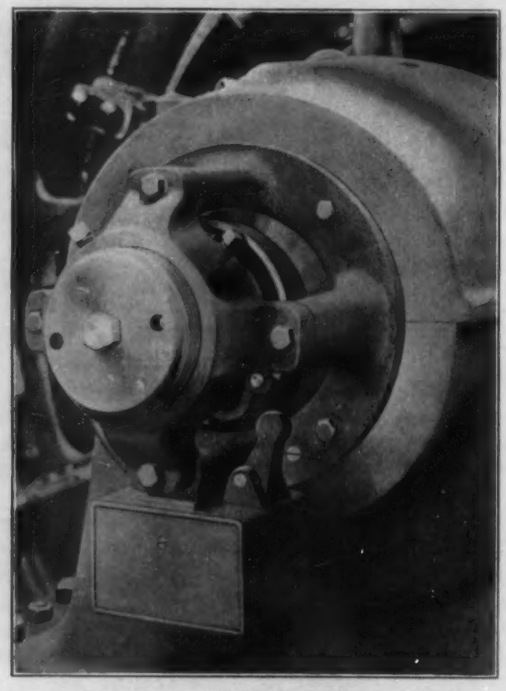


Fig. 1. New Overspeed Limit Device Installed on a Rotary Converter. An Oscillating Mechanism of the Standard Form is Also Shown.

If the speed of the machine exceeds the value (usually 15 per cent overspeed) for which the device is set, the trip lever, due to its centrifugal force, flys outward positively and quickly, and, knocking over the switch arm, closes the switch. A most interesting and important point in connection with its action is its positiveness. If the trip lever starts to fly out, the speed remaining constant or increasing, it will continue until it strikes the stop. This action is due to the proportions and disposition of the trip spring and the trip-lever.

The point on the trip-lever that strikes the switch-arm is approximately at the center of percussion of the lever, a fact which insures an effective blow being struck by the lever.

Normally the switch-arm is held in the open position by a toggle spring. The relation of the spring to the lever is such that the resisting torque of the spring is a minimum. When the trip lever strikes the switch-arm it forces the arm past the center point of the toggle mechanism and the switch, under the spring's tension, closes of itself.

It is only necessary for the trip-lever to move the arm a small distance, possible 3/32 in. to insure that the switch will close. The relation of the parts is such that, when the arm is in the closed position, the contacts are forced against the contact blocks with considerable pressure much more than is required to trip the switch.

To reset the switch it is merely necessary to move the switch arm back to the normal position by hand. This can be readily done at any time whether the machine is running or not and without opening the switch box.

That very few parts are involved is evident from an inspections of the illustrations. Obviously, the fewer parts in a mechanism the better it is, other things being equal. The minimum diameter for any bearing pin is ½ in., and the other parts are correspondingly strong. Adjusting screws are provided whereby the position of the trip lever can be closely

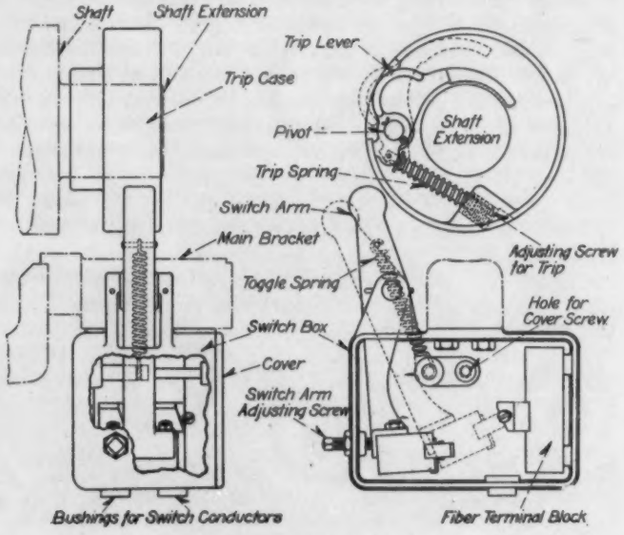


Fig. 2. Assembly Drawing of the Overspeed Limit Device.

regulated so that it will act at the predetermined speed. The sensitiveness of action of the switch arm can also be regulated by an adjusting screw.

Electrical connections for the new device will be the same as those used for the former Westinghouse standard overspeed trip arrangement. If the converter attains an overspeed the trip lever flys out, the switch arm forces its contacts against the contact blocks and an auxiliary circuit is closed. With the usual scheme of connections, the closing of this circuit energizes the solenoid of a tripping device (on the alternating-current circuit-breakers) which operates and opens the breakers, cutting the machine from its source of supply.

In addition to the overspeed limit switch illustrated, which must reset manually, another switch has been developed which can be reset by a solenoid arranged within the switch box. A circuit extends from the solenoid to the switchboard and the equipment is so designed that, after the switch has been tripped, it can be reset by closing the solenoid circuit with a contact button located at the switchboard or any other convenient point. This electrical resetting arrangement is not standard and is furnished only when specified by the purchaser.

The Westinghouse Electric & Manufacturing Company has received an order from the Seattle, Renton & Southern Railway Company, Seattle, Washington, for five complete cars equipped with five double No. 317 motors and AB USG control.

THE INCREASING USE OF THE TELEPHONE FOR TRAIN DISPATCHING.

The introduction of the telephone in the field of train dispatching still goes on with rapid strides. Its success has been emphatic and very gratifying to the officials on whose roads it has been installed. Of the railroads in the United States, which have adopted the telephone for handling trains, ninety per cent are using the well known apparatus manufactured for that purpose by the Western Electric Company.

The New York Central and Hudson River Railroad a month or so ago placed an order for forty-five telephone sets and miscellaneous supplies, to be used in extending their system; and more recently, placed a further order for seventy similar telephone sets, fifty-four transmitter arms, thirty portable telephone sets with the same number of line poles, sixty test panels and a considerable quantity of miscellaneous supplies.

In the West, the Davenport and Muscatine Railway Company, operating between Davenport, Iowa, and Muscatine, Iowa, a distance of about 25 miles, is installing a four selector and telephone way-station equipment, four selector semaphores and four siding telephones. In the South, another railway system to adopt the telephone is the Gulf, Florida and Alabama Railway of Pensacola, Florida, which has given the Western Electric Company an order for equipment for 100 miles of line. The apparatus to be furnished consists of twenty selectors, fifteen siding sets, twelve portable sets and the necessary line material.

Other railroads in the East and South, so it is reported, are constantly sending in "repeat" orders. The Lehigh Valley will install a special yard dispatching circuit consisting of eight complete selector stations, and have also ordered one hundred and forty portable telephone sets with line poles. A total of fifty-five wall telephones and miscellaneous material for train dispatching circuits is going to the Norfolk and Southern Railroad Company, while the Norfolk and Western has ordered ninety adjustaphones (transmitter arms) with the necessary generator sets and miscellaneous pole line hardware for two dispatching circuits.

The Chesapeake and Ohio is steadily extending its telephone lines and has recently installed forty-six additional desk type telephone sets with miscellaneous line material; and for use on the line between Columbus, Georgia, and Birmingham, Alabama, the Central of Georgia has ordered thirty portable sets and line poles. The Baltimore and Ohio will shortly install thirty-five additional way station outfits.

All in all, the past successes of the telephone in train dispatching are more than encouraging, and its future looms up brightly.

The old adage "An ounce of prevention is worth a pound of cure," is rather shop-worn, but nevertheless it is as true now as when it was first written. Much has been said concerning the many ways in which the telephone has helped the railroads after an accident has occurred, such as getting information to headquarters and the starting of wrecking and relief expeditions to the scene of the disaster.

From the middle west there comes a tale which demonstrates that the telephone played an important part in an accident "that didn't happen." A track-walker on one of the trans-continental railroads in stepping back upon the right-of-way after a fast train had passed, noticed a broken flange, that had ripped off one of the wheels of a car, lying along the rails. What did this mean? It meant that one of the wheels was traveling at the rate of 45 or 50 miles an hour without a guide-band. It might go on through the entire journey without causing trouble, but, then again, in going around a curve, it might cause that particular truck to leave the rail and——; but why speak of the disagreeable.

The track-walker hastened to a siding switch, which was equipped with a Western Electric iron case telephone set, and told the dispatcher of his find. The dispatcher immediately telephoned ahead and had the train stopped, the damaged car removed from the tracks, and thus a possible accident was prevented.

A NEW PENDENT SWITCH.

"Dainty" is the word that best describes the new pendent switch just placed on the market by The Cutler-Hammer Manufacturing Company of Milwaukee. The brass shell, fashioned like an acorn, is only a trifle over 1¾ inches in height and a single switch weighs less than two ounces.

The attractive appearance of this switch and the remarkable reduction in size and weight have been attained without any sacrifice of serviceability. Removal of the cap (which is held in place by a snap lock) reveals a simple but rugged interior mechanism operated by a straight push-bar, similar to that used in Cutler-Hammer porcelain pendent switches. Ample terminal space is provided for wiring and the Underwriters' label testifies to the fact that the new switch has successfully met the rigid requirements of the Underwriters' Laboratories.

New Pendent Switch.

The "Acorn" switch operates with a quick snap and the whole of the operating mechanism, except the projecting push buttons, may be concealed under a half-dollar. No porcelain is used in the construction of this switch, a new insulating material, developed in the ceramic laboratory of The Cutler-Hammer Manufacturing Company being used for supporting the operating mechanism. This new material is said to be unbreakable under ordinary service conditions and can be molded with much greater accuracy than porcelain, insuring proper alignment of parts and smoother operation when the switch is assembled.

The brass cap is designed to be snapped onto the shell and is provided with a hard rubber bushing which accommodates either standard or reinforced flexible cord. In spite of its small size the new switch has the usual ampere capacity for snap switches, being rated at 6 amperes, 125 volts or 3 amperes, 250 volts.

NEWS NOTES

INCORPORATIONS.

SEATTLE, WASH.—A. G. Electric & Manufacturing Company, by A. G. Griswold, T. S. Lippy and others.

SEATTLE, WASH.—W. H. Shepard and a Mr. Cameron have incorporated under the name of Vancouver Monorail Company, with a capital of $10,000, for the purpose of building monorail roads in British Columbia.

BOISE, IDAHO.—The Snake River Power Company has been incorporated with capitalization of $900,000, by W. E. Pierce, J. A. Pinney and Willard White, the chief promoters. They will supply power and light to Boise and other cities.

SALEM, ORE.—Fred A. Jacobs, C. W. Hodgson and G. M. Shrock have filed articles of incorporation for an electric railway in Portland to connect with certain lines of the present system in Portland. The new line is known as the Errol Heights Railway Company. Capital stock, $20,000.

RIVERSIDE, CAL.—Articles of incorporation have been filed for the Riverside-Redlands Interurban Railway Company, with capital stock of $500,000. William S. Peloubet and Maurice Salxman of Los Angeles and R. E. Smith of Riverside are directors. Electric railway lines will be operated in Riverside, Redlands, San Jacinto and Hemet.

PETALUMA, CAL.—With the object of securing a coast outlet for the Petaluma and Santa Rosa Railway, articles of incorporation have been filed of the Petaluma and Coast Railway, which will run from Liberty on the line of the former road to Bloomfield and thence to a point on the coast near Bodega. The road will be 18 miles long and its headquarters will be in Petaluma. The capital stock is given as $250,000, divided into 2500 shares, and $22,000 has been subscribed. The five directors and the amounts of their subscription are: J. E. Alexander, $21,600; B. Levy, A. F. Hoehmer, D. S. Hyde and W. P. Ferguson, $100 each. The first four live in San Francisco and Ferguson in Santa Rosa.

TRANSMISSION.

CHEHALIS, WASH.—The County Commissioners postponed the granting of a franchise for a power line south of Napavine to the Washington-Oregon Corporation until April 1. With this franchise the company will go ahead with its line from Tenino to Kelso.

TACOMA, WASH.—The City Council has authorized Commissioner Hamilton F. Gronen of the department of light and water to apply to the county commissioners for a 25-year franchise for the transmission line of the Nisqually power project and for a telephone line.

BOISE, IDAHO.—The Great Shoshone & Twin Falls Water Power Company are making preparations for constructing a line from Mountain Home to Boise, to get into the local field. Application to the federal authorities for right-of-way has been made.

HUSUM, WASH.—A syndicate said to represent the Northwestern Electric Company has purchased a tract of 60 acres, located on both sides of the White Salmon River about three miles below here. It is claimed this will be the location of the proposed power plant of the Northwestern Electric Company, whose plant will cost $1,000,000.

LOS ANGELES, CAL.—By filing trust deed for $1,000,000 in the County Recorder's office, the Electric Power Company paved the way for erection of a big power house at headwaters of the San Gabriel River. Franchise rights for transmission lines through Angeles National Forest Reserve were granted the company several years ago. Filing of deed is last step in getting the work under way, according to Secretary Foreman. In addition to the plant several big flumes and tunnels will be constructed.

FALLON, NEV.—Sealed bids will be received by the U. S. Reclamation Service at Fallon, until 2 p.m. April 10, for distribution of materials and work of constructing to complete about 17 miles of electric transmission line extending from Lahontan to Fallon. The line consists of 35-foot poles, spaced 250 feet apart, carrying three No. 5 3-strand copper conductors on porcelain insulators, for transmission of 30,000-volt current. All materials furnished by the Government. Certified check of $200 is required with each bid, and bond of $500 is required of contractor. Further information may be obtained by calling on U. S. Reclamation Service, Fallon, Nev.

FRESNO, CAL.—The Pacific Light & Power Company has begun its plan of extension projected months ago by Henry E. Huntington, A. C. Balch and W. G. Kerckhoff, to make this corporation the greatest of its kind in Western America. The plans of the company and its expenditures in the building of the Big Creek power dam were recently announced. The railroad is to be used in connection with it in the Kern County district; and power lines will be strung all over Southern California to give light and power for electric railroads and cities. In furtherance of this scheme of extension the company has just closed a deal for the purchase of five local plants which will add greatly to the distributing outlet of current. The plants purchased are those at San Miguel, Paso Robles, San Luis Obispo, Arroyo Grande and Santa Maria. The price paid is in round numbers $1,000,000 and immediate possesion is given. It is the intention to bring the "juice" for these plants across the mountains from the big hydroelectric plants as soon as they are completed, thus connecting the coast power plants with those of the San Joaquin Valley. Improvements and additions involving an expenditure something like $3,000,000 are contemplated for these places and work will be commenced within the next few weeks of adding to and improving the local lighting and power systems in these cities.

ILLUMINATION.

LYLE, WASH.—Plans are under way for the construction of an electric light plant here. It is understood the light plant is to be financed by Le Roy Park, D. E. Keasey and their associates of Portland.

SACRAMENTO, CAL.—The rate war is on in the suburban districts between the Pacific Gas & Electric Company and the Great Western Power Company. Both companies are offering a cut rate for residents from 9c to 7c per kw. and to business houses a reduction from 8c to 5c per kw.

SAN JOSE, CAL.—Plans and specifications were adopted for the installation of 125 arc lights and a lighting system in the new College Park Lighting District, and the Clerk was authorized to advertise for bids for a five-year contract for power and the installation of the system, the bids to be opened April 15th.

TRANSPORTATION.

MARTINEZ, CAL.—The Board of Supervisors passed an ordinance granting to R. D. Rousfield, a citizen of the city of Berkeley, the right and franchise to construct and operate for a term of 50 years a single or double track street railroad in the southern part of Contra Costa county.

BELLINGHAM, WASH.—A railway line from the city limits to Geneva will probably be built. Inducements in the way af right-of-way and money are being made the street car company.

MILWAUKIE, ORE.—The Southern Pacific Railway is asking for an ordinance for electrifying its line which passes through Milwaukie and crosses the Willamette River at Oswego, known as the Beaverton cut-off.

FAIRFIELD, CAL.—The Vallejo & Northern Railroad Company have been granted a franchise to construct, lay down and operate by means of electricity a single or double track railroad in certain streets in this town.

GLENDALE, CAL.—E. D. Goode has secured right of way for a railroad which will run from Fourth street and Brand Boulevard, Glendale, west on Fourth street to Pacific Avenue, south on Pacific to Oak drive, thence on Oak drive west to and across the Los Angeles River, connecting with the southern end of aviation field. It is expecfed the line will be constructed and in operation in four months.

SAN FRANCISCO, CAL.—Mayor Rolph and the members of the Supervisors with J. R. Bibbins, the traffic expert; Michael Casey of the Board of Public Works anod City Attorney Long personally inspected the route of the Geary-street municipal railway. At the conclusion of the inspection the Supervisors decided to ask Bion J. Arnold and J. R. Bibbins, the traffic experts, to render a report as to the best route to be used, considering the engineering and operation problems involved, and the revenue to be produced.

VISALIA, CAL.—An announcement has been made to the effect that the Tidewater & Southern Railway, now in the course of construction between Stockton and Turlock, is to be extended through the Alta section of Dinuba to Visalia. The new electric railway is under contract to be in operation into Turlock by July 4th and into Fresno by January 1, 1913, so that Visalia is expecting to see trains running to this city in less than a year. It is the plan of the road to run from Fresno south through Selma to Dinuba, thence through Orosi and Yettem to Visalia, and from this city south to Tulare, thence east to Lindsay and Porterville and south to Bakersfield, the present terminus.

SAN FRANCISCO, CAL.—Mayor Rolph is determined to see construction work begun at once on the car barns and substation of the Geary-street road. When the public utility committee hesitated about its authority to order the preparation of plans Rolph assumed full responsibility. City Engineer Loren Hunt stated that the amount already expended and contracted for is $562,000, which includes all material purchased or ordered for the road from Fifth avenue to Kearny street. The total construction will cost $2,980,000. For track construction $100,000 has been spent and $400,000 remains to be expended. Hunt estimated that the track construction can be finished in six months.

RICHMOND, CAL.—That the Southern Pacific Company contemplates the extension of its electric suburban system on the east side of the bay to Richmond is indicated by a map filed with the County Surveyor at Martinez which provides for an electric railroad through the Henderson tract to connect the Southern Pacific's electric lines in North Berkeley with the Cutting boulevard. H. C. Cutting has applied to the City Council for a franchise for an electric line to extend over the boulevard from its easterly end to the business center of Richmond. It was generally supposed that he expected the Key Route to build this road, but it is now understood that the Southern Pacific will do so.

COLUSA, CAL.—Maney Bros. have sublet contracts for the grading of the Marysville-Colusa branch of the Northern Electric. Harlan Bros. of Williams have the section from Terra Buena to a point a few miles east of Sutter City. The next section from the Humphrey place to Sutter City will be handled by C. Bell, who has been doing the grading for the Sacramento Woodland Electric line. The work from Sutter City to the Lon Summy place will be handled by J. Hennigan. The section from the Summy place to Butte Slough has not been arranged for as yet. From Butte Slough to a point half way across Reclamation District 70 will also be done by Hennigan, and from Meridian to Colusa on the west side of the Sacramento, the contract has been awarded to Harlan Bros.

VANCOUVER, B. C.—The British Columbia Railway Company has placed an order for 24 interurban cars with the St. Louis Car Company, the additional rolling stock, with electrical equipment representing an outlay of $250,000. Twenty-two of the cars are intended for passenger service. The company has prepared plans for a new substation on Earl's Road, Scuth Vancouver, for the regulation of its light and power service in that district as well as on the Westminster interurban line, along which the station is located. The electrical equipment will consist of two 1000 kw. motor generator sets, two banks of transformers of 3000 kw. each for light and power service, eight arc regulators with a total capacity for 800 lamps and a switching station for a 10,000 volt feeder switch. The total investment at the point will be $125,000.

SAN FRANCISCO, CAL.—Bids for the construction of the municipal railroad on Geary street from Fifth avenue to Kearny street were opened March 27, by the Board of Public Works. There was considerable variation in the bids. The lowest was submitted by Bates, Boland & Ayer, its amount being $225.025, and the next was that of the State Construction Company, $253,110. The other bids, there being ten in all, were: Mahoney Bros., $283,845; E. B. & A. L. Stone Company, $295,370; Healy-Tibbits Construction Company, $297,350; Contra Costa Construction Company, $321,640; Willett & Burr, $332,920; City Street Improvement Company, $314,458; Chadwick & Sykes, $349,790; Grant, Smith & Co., $361,770. The Board approved the specifications submitted by the city engineer for the sub-station which is to be built at the car barn of the municipal railroad.

TELEPHONE AND TELEGRAPH.

PLANADA, CAL.—Planada is to have a telephone system in the near future. J. Harvey McCarthy will promote the new enterprise.

TACOMA, WASH.—The franchise of the Home Telephone Company has been revoked by the City Council. It cost the company $550,000.

CHEHALIS, WASH.—The Saint Urban Telephone Company has been granted a franchise for 25 years to erect and maintain poles on certain county roads.

LAKEPORT, CAL.—The completion of the organization of a new farmers' telephone company has been effected at Upper Lake, practically assuring the carrying out of a plan which for some time has been entertained of building a grounded line from Upper Lake to Lakeport. Actual construction of the line will be commenced as soon as the poles can be secured from Polk's mill.

SAN FRANCISCO, CAL.—The first legal attempt to block the sale, transfer and merger of the Home Telephone Company was begun Saturday when O. L. Scott, a tailor, through his attorney, applied for a restraining order before Superior Judge Lawlor to prevent the consummation of the transaction. On the application of Attorneys Albert L. Johnson, Wiley F. Crist, C. W. Eastin and Ferno J. Schuhl, representing Scott and various organizations in the city, Judge Lawlor granted a temporary injunction and set the time for hearing as next Saturday morning at 10 o'clock. At that time the restraining order will either be made permanent or will be dissolved.

SANTA MONICA, CAL.—Officers of the Santa Monica Bay Chamber of Commerce have discovered that the Sunset Telephone Company has no franchise in Venice, and the

City Trustees will be asked to compel the concern to combine with the other phone service or cease operation. The victory of Pasadena under similar circumstances is cited as the precedent that makes the position of the Venice Board impregnable. The Santa Monica Bay Home Telephone Company is ready, say officers of the commercial body, to enter into any reasonable agreement with the other company that may be offered. Mayor Dow tried to begin proceedings for a single telephone service in the beach district, but the report of that action must begin in Venice. The Santa Monica Council will be asked, however, to lend co-operation.

SAN FRANCISCO, CAL.—Declaring it to be against public policy that the Home Telephone Company should be merged with the Pacific Telephone & Telegraph Company and calling an election to determine whether or not the city should issue bonds in the sum of $6,000,000 for the purchase of the Home company's plant, the result of last week's special election does not finally settle the question at issue, as it merely calls another election for the purpose of determining whether the city shall buy the Home's plant. For the first proposition declaring it to be a public necessity for the city to acquire a telephone plant, and that the public interest requires that the proposed merger of the two companies be defeated, the vote was 21,174 for and 10,353 against. On the second proposition, which is in the form of an ordinance calling a special election on the question of incurring a bonded indebtedness of $6,000,000 for the purchase of the plant of the Bay Cities Home Telephone Company the vote stood 20,500 for and 10,665 against. This vote falls short of giving the two-thirds majority which would have been necessary had this election been for the purpose of directly deciding the question of the purchase of the Home company's plant by the city.

WATERWORKS.

TACOMA, WASH.—Water meters are to be placed in factories, hotels, laundries, livery stables, barber shops and creameries in this city.

BOISE, IDAHO.—The Boise Artesian Hot & Cold Water Company will within the next three months spend $100,000 in Boise in the laying of water mains, and the construction of a mammoth reservoir.

OROVILLE, CAL.—Announcement that work on the construction of the dam at Big Meadows would begin April 15 was made by Jesse Baumgardner, superintendent o. hydraulic construction for the Great Western Power Company.

SAN DIEGO, CAL.—May 7 is the date which has been fixed to hold an election for the issue of $680,000 in bonds to extend sewers, water mains, and make certain improvements to streets, which includes building and repair of bridges.

CENTRALIA, WASH.—At a meeting of the City Commissioners in Centralia an ordinance providing for the installation of a municipal gravity water system passed final reading. The election to vote bonds with which to construct the plant will be held on May 7th.

TACOMA, WASH.—Preparations for the letting of a contract as soon as possible for the final unit of the Green River gravity system which will connect the pipe on Wright avenue with the J street standpipe, are being made. This final unit will cost about $140,000.

GRASS VALLEY, CAL.—Despite recent rains all mining companies have been notified by water companies that no power can be furnished after June 10. The supply is only sufficient for the towns in this section. The larger mines probably will install electric power.

WILLOWS, CAL.—The Northern California Power Company, which owns the local water system has closed a deal for the purchase of a two-stage centrifugal pump which will practically double the capacity of the plant. The pump will be operated by a 30 h.p. electric motor.

RAYMOND, WASH.—This city has employed an expert engineer to estimate the probable cost of a municipal water system. It is proposed to take over the private plant and enlarge and improve it by laying heavier mains and building a reservoir with a capacity sufficient for the needs of the city.

LOS ANGELES, CAL.—The cities to be served by the Owens water distribution are: Pasadena, South Pasadena, Alhambra, Santa Monica, Venice and smaller communities lying between Los Angeles and Crescent bay, an area of 195,000 acres. Pipe lines are to be divided into four cases by the engineer and with each case is carried the route and estimated cost.

LOS ANGELES, CAL.—The Tejunga Water & Power Company will expend $1,000,000 which it has secured through a deed it has executed through the Los Angeles Trust and Savings Bank. The Owensmouth, the Marion and Van Nuys Water Companies have also taken trust deeds through the Title Trust & Insurance Company, calling for an increased indebtedness of $50,000 for each company.

SUTHERLIN, ORE.—At a special meeting of the City Council the contract for digging a large well, constructing a reservoir and installing a distributing system of waterworks was awarded to Jeffery & Bufton of Portland for $14,881.15. The distributing system includes six in. mains on the principal streets with numerous hydrants for fire purposes. The reservoir is to be of concrete and of 50,000 gallons capacity.

GLENDALE, CAL.—The City of Glendale has entered into an agreement to purchase the waterworks from F. H. Sine. At the earliest possible moment a meeting will be called to decide upon the issue of $15,000 bonds to cover the purchase of the waterworks and also at the same town meeting the full particulars regarding the purchase of the electric light plant will be brought forward and decided upon.

OREGON CITY, ORE.—The Common Council of the City of Gladstone, will receive bids for the purchase of $20,000 of the negotiable coupon bonds of said town bearing 6 per cent semi-annual interest from the date of issue. The bonds are for the purpose of building and maintaining a water system in said city. Bids are to be received and filed with the recorder of said city at any time before 7:30 p. m., April 9, 1912.

EL PASO, TEXAS.—The Guadalupe Water Power Company of Seguin, Tex., recently formed with a capital stock of $600,000 will construct a series of dams and hydroelectric plants on the Guadalupe river between that place and New Braunfels. The same interests are working to form a company to construct an interurban electric line between Seguin and New Braunfels and San Antonio. W. J. Crawford, W. B. Dunlap and J. M. Abbott are interested in the project.

MODESTO, CAL.—By the introduction of an ordinance providing for the issuance, sale and redemption of 85,500 water bonds at the City Council meeting recently and the appointment of F. C. Roberts of the firm of Roberts & Denicke, expert engineers, of San Francisco as consulting engineer for the work, Modesto commenced actual steps on the re-organization and improvement of the municipal water system. The plans provide for the erection of steel tanks with a total capacity of 300,000 gallons, the installation of new and powerful pumps and the laying of a larger and more effective distributing system.